

FEBRUARY 1964 35 CENTS ICD

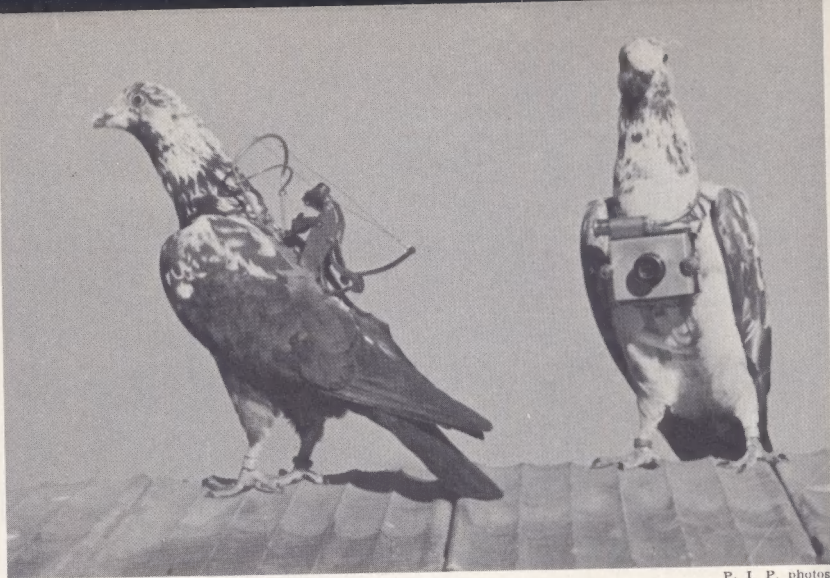
# SCIENCE DIGEST

## 'I EXPECT TO CATCH HELL'



# A KINSEY COLLEAGUE REPORTS ON MARRIAGE AS IT REALLY IS

WINTER HEALTH—SHOULD YOU GO SOUTH?  
MEET OUR FIRST WOMAN NOBEL PRIZE WINNER  
SST: AVIATION'S BIG LEAP IN THE DARK



P. I. P. photos

## Feathered photographer

WHEN Febo de Vries of Basle, Switzerland, combined his two hobbies, pigeon raising and photography, he came up with a camera-carrying pigeon that could take pictures on the wing.

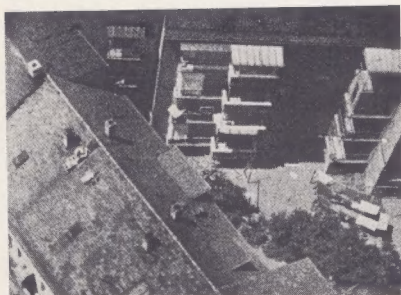
He designed a lightweight miniature camera and taught his pigeons

to fly with it. The camera has an automatic device which opens the shutter at a given moment.

A hitch developed because a camera-carrying pigeon (above right) was slowed in flight and became easy prey for other birds. So de Vries gave it a "fighter escort," a pigeon that carries a special shooting device (above left).

As soon as an attacking bird touches a thread on the back of the escort, the device shoots a pellet and scares the attacker away. Of course, the camera bird can still be attacked but his chances are now better than they used to be.

"My pigeons have taken some wonderful high-altitude photographs," says de Vries. "Very beautiful, very artistic."



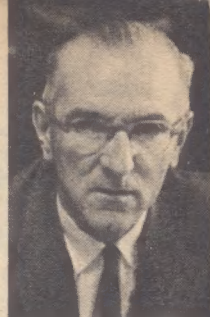
This bird's-eye view of apartment buildings was taken by (what else?) a bird.



# SCIENCE DIGEST

Twenty-eighth year of publication  
Front cover photo: Three Lions

Former Kinsey colleague  
Dr. John Cuber (right) finds that most  
'successful' marriages are  
held together by hatred  
or sheer inertia. The first  
public account of his startling  
studies starts on page 6.



**FEBRUARY • 1964** VOL. 55, NO. 2

## ARTICLES

FEATHERED PHOTOGRAPHER.....	Inside front cover
PIECES OF THE MOON.....	5
MARRIAGE AS IT REALLY IS.....	6
HOW TO CATCH A GIRAFFE.....	20
SST—AVIATION'S LEAP IN THE DARK.....	23
AT HOME WITH MARIA MAYER.....	30
YOU CAN LIVE ON YOUR WASTE.....	37
THE UNIVERSITY THAT WENT TO SEA.....	40
A PRIEST LOOKS AT EVOLUTION.....	44
THE BIG DRIP.....	45
THE STRANGEST AFRICANS.....	48
WINTER HEALTH—SHOULD YOU GO SOUTH?.....	57
MEDICINE'S NEXT BIG STEP—SPARE PARTS SURGERY.....	65
THE POET IS A COMPUTER.....	70
HOLE IN THE HEAD.....	72
COLUMBUS WASN'T FIRST.....	77
THE NEW SCIENCE OF DRIVING.....	86
THE WONDERFUL LAMP.....	Inside back cover

## FEATURES

LETTERS.....	2
THE MACHINE THAT READS HANDWRITING—Inventor of the Month....	52
ENEMY SUBS, BEWARE!—Inventions, Patents, Processes.....	52
THE EARTH'S PAST—Your Science ABC's.....	62
IS ADVERTISING PSYCHOLOGY OUTDATED?—What's on Your Mind?....	73
WHAT DOESN'T CAUSE HEART ATTACKS—The Progress of Medicine....	81
SCIENCE IN THE NEWS.....	91



HUBERT PRYOR, *Editor*; DANIEL COHEN, *Assistant Editor*; BRUCE H. FRISCH, *Assistant Editor*; CHARLOTTE H. PEASLEE, *Assistant Editor*; GEORGE KELVIN, *Art*; BARBARA J. MUTH, *School Department*.

**SCIENCE DIGEST** is published monthly by Popular Mechanics Company.

RICHARD E. BERLIN, *President*; RICHARD E. DEEMS, *Vice-President*; FRED LEWIS, *Vice-President*; JOHN R. MILLER, *Vice-President*; JOSEPH F. KERN, *Vice-President*; FRANK MASSI, *Treasurer*; R. F. McCauley, *Secretary*.

Editorial and general offices at 1775 Broadway, New York 19, N.Y. Subscription offices at 250 West 55th Street, New York 19, N.Y. © 1964 by Popular Mechanics Company.

## ARE YOU MOVING?

To insure magazine delivery at your new address PLEASE NOTIFY US NOW, OR SURELY 6 WEEKS IN ADVANCE OF YOUR MOVING. Write in old and new address below; if possible include the address label from your last issue.

Please mail this form today to:  
**Science Digest**, Subscription Dept.  
 250 West 55 St.  
 New York, N.Y. 10019

ATTACH LABEL HERE OR WRITE  
 YOUR OLD ADDRESS

Name \_\_\_\_\_ Please print

Address \_\_\_\_\_

City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_

Be sure to give us your  
**NEW ADDRESS**

Name \_\_\_\_\_ Please print

Address \_\_\_\_\_

City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_

Magazine \_\_\_\_\_

**SUBSCRIPTION PRICES:** U.S.A. and Possessions, \$4.00 for one year; \$7.00 for two years; \$10.00 for three years. Canada, add 50¢ for each year. All other countries, add \$1.00 for each year. Special Teachers' and Students' rates available through **SCIENCE DIGEST School Plan**. 25¢ a copy, minimum order 10 copies per month. Write to: **SCIENCE DIGEST School Dept.**, at address below. Subscription Service: Mail all subscription orders, changes of address, correspondence concerning subscriptions, and Postmaster notices of undeliverable copies to **SCIENCE DIGEST**, 250 West 55th Street, New York 19, N. Y.

Second-class postage paid at New York, N. Y., and at additional mailing offices. Registered as second-class mail at the post office, Mexico, D. F., Mexico, June 20, 1950. Authorized as second-class mail by Post Office Department, Ottawa, and for payment of postage in cash. *Science Digest* is indexed in *Reader's Guide to Periodical Literature*. Printed in the U.S.A. Unsolicited manuscripts must be accompanied by a self-addressed and stamped envelope.

# LETTERS

TO  
 SCIENCE DIGEST

## Evolution and the Bible

In reference to B. E. Carlson's letter on the subject of dinosaurs and the Bible (Nov. '63): He is attempting to compare two things which are incomparable. The Bible is not a scientific history! It is a religious history and nothing more.

The creation account, which Mr. Carlson evidently believes to be a revealed truth, does not fall under this category. In the Bible, facts fall into two categories—revealed and inspired truths. Revelation does not include the whole Bible, but merely those truths which are unattainable through human reason. Inspiration is truly a supernatural influence qualifying men to receive and communicate divine truth, but it does not imply the use of God's exact words. God inspires the Biblical author to write in the author's own style. Hence the creation account is merely a literary framework in which the author attempts to portray the fact that God is the sole architect of all creation.



To believe that the process of creation can be traced to six days—or six periods of time—is to hold a position which is contradicted by indisputable scientific research.

Mr. Carlson is again off base by stating that science is attempting to disprove the Bible. It is impossible for either to disprove the other since they are concerned with two different objectives—one with natural phenomena and the other (the Bible) with the Lord God and His providence.

WILLIAM X. LAMB, III  
Saint John Vianney Seminary  
Elkhorn, Nebr.

Such persons as B. E. Carlson seem utterly unaware of these facts: 1. Scholars in many fields, not biology alone, long ago became convinced of the truth of evolution. 2. The evidence of organic evolution is positive and indisputable. 3. Evolution is the only explanation for the tre-

mendous diversity of animal and plant life. 4. Theological scholars understand and explain that the Bible is not God's word, but what various men who wrote in the pre-scientific age thought was God's word. 5. All the liberal groups of religious people find nothing irreligious in the acceptance of evolution.

WALTER C. KRAATZ, PH.D.  
Akron, Ohio

If dinosaurs did not live, B. E. Carlson is faced with the task of explaining away tons of fossilized proof. If man and dinosaurs were created together, where are the dinosaurs today?

We must remember that the Bible, one of the greatest influences in the history of mankind, cannot be considered to be the absolute authority of science, as it is of religion. We must accept it for the great work which it is, and not try to use it as  
*(Continued on next page)*



a catch-all to explain away any fact which we do not like.

HAROLD J. HOPKINS  
Austin, Texas

*For more on this subject, see page 44.—Ed.*

### Nyet

In "Russian in Two Hours" (Nov. '63), Chekov and Shostakovich are misspelled in Russian.

I've read *Science Digest* for over a quarter century, so I have a funny kind of affection for it.

S. BORODIN  
Brooklyn, N.Y.

*Thanks for the correction and the affection.—Ed.*

### The Negro (cont.)

Thank you for your articles on the American Negro (Oct. '63). I believe in equal rights for all races. We are all the children of God. I don't believe in prejudice in any form.

*Science Digest* is tops, in my opinion. I have learned more from your magazine than I did in college.

TOM W. DANIELSON  
Cincinnati, Ohio.

Your article "The Negro—How He's Different" (Oct. '63) does not seem to be appropriate for a magazine designed to enlighten the general public about science. As a teacher of history, I have material written by authorities as reputable as yours that presents quite a different picture from that drawn by you because of the nature of your selectivity. I would suggest that *Science Digest* present

what is known and not known or leave such topics to magazines whose method of presenting many different authorities gives a broader base for thinking, and putting life in proper perspective. Otherwise one can only believe that you are attempting a brainwashing program and playing an obscurantist role because you want your desires to supplant realities. This, I suggest, is unworthy of the good job you have done.

JOHN E. LAMBERT  
Gaithersburg, Md.

### The pied piper

Reading your article "Long Live the Cockroach" (Nov. '63), I was reminded of the time when I ran a small shop devoted to the problems of inventors. One day a woman came in and said she had moved into an apartment that was full of roaches. What was she going to do about it?

I asked the woman why she didn't buy a roach whistle. A roach whistle? What does it do?

I explained that one stands over the sink, blows the whistle and turns on the water and washes the roaches down the drain when they appear. She had heard about a dog whistle and that was enough. Where could she get one—Macy's? No they did not handle them, because they figured that it needs a demonstration, and who ever heard of Macy's having roaches? She could try Abercrombie and Fitch, who carry all kinds of whistles.

One never knows what a chance remark will lead to. . . .

FRED ROTH  
Santa Monica, Calif.

*Indeed, one never knows.—Ed.*





## pieces of the moon

Two General Electric scientists may have solved a major scientific mystery—and created an even bigger one.

Strange glass objects—called “tektites” and “impactites”—are found by the thousands in sites scattered across the earth. One widely-held theory is that tektites are solidified droplets of lunar material melted and splashed into space when large meteorites crashed into the moon. Impactites, by contrast, are thought to be products of the impact of large extraterrestrial objects against the earth.

Drs. P. Buford Price (left) and Robert L. Fleischer, using a new technique for dating geological spec-

imens, have discovered that impactites were formed at the same time as tektites in the same region.

By comparing samples gathered around the world, scientists figure that at least three major tektite falls have taken place, one 34 million years ago, another 15 million years ago, and the third 700,000 years ago. In each instance, nearby samples of impactites were found to be the same age.

The new dating method used by Drs. Fleischer and Price is based on the trace amounts of uranium that are found in nearly all rocks, including tektites and impactites. Uranium atoms undergo natural fission at a known rate, splitting into fragments of roughly equal size. As the fission fragments move apart in the rock, they leave a trail of damage a few atoms in diameter. By counting the number of tracks, the age of a rock can be determined. The more tracks, the older the rock.

Tektites (shown in an enlarged picture beneath Dr. Fleischer's arm) are too small to have smashed impactites into existence. Thus the tektites must have fallen along with much larger objects which formed the impactites.

Were these much larger objects chunks of the moon? The evidence points that way.

On the basis of their research, the scientists believe that more lunar material may be present on earth than was realized previously. The new mystery: Where is this material and what are its characteristics?

# THE FIVE KINDS OF MODERN MARRIAGE

## Conflict

*Tension, rather than compatibility, holds the marriage together.*

*There is a constant struggle, sometimes lasting a lifetime, to control hostility.*

*Tension erupts in sustained quarreling, nagging and "throwing up the past."*

## Apathy

*Habit and sheer inertia prevent husband or wife from breaking up the union.*

*The relationship loses zest and meaning early in marriage.*

*Occasional periods of participating in common activities are the only bond.*

## A KINSEY COLLEAGUE REPORTS ON

# MARRIAGE AS

by Sidney Katz

IN THE eyes of the world, there are only two kinds of marriage—successful and unsuccessful. The second kind, as everyone knows, is the kind that has ended in divorce or separation, or is about to.

Through a desire to be helpful, sociologists, psychologists, marriage counselors and other "experts" in human relationships have focused their attention on unsuccessful marriages. What research and thinking

has been done on the subject of successful marriage has been rudimentary; even sociologists assume that such a marriage is a going concern, that the couple is reasonably satisfied, and that "successful" marriages are pretty much alike.

In vociferous disagreement with this one-dimensional view of "successful" marriage is Dr. John F. Cuber, a tall, dynamic, fifty-two-year-old Ohio State University sociologist. Cuber is the author of some six sociological texts and has had wide experience in the field of marriage counseling. Recently, as-

Reprinted with permission, copyright 1963 by MacLean's, Toronto, Ontario, Canada.



## Passivity

*A feeling of comfortable adequacy keeps the partners together.*

*Impersonal interests are used to cover the absence of any personal relationship.*

*Husband and wife gingerly side-step the important issues of their marriage.*

## Vitality

*Sharing of one important lifetime experience makes the marriage strong.*

*Children, hobbies, or sex can give a marriage this vital ingredient.*

*Both partners feel that they are indispensable to the marriage and to each other.*

## The total marriage

*Husband and wife share fully in every aspect of their life together.*

*The relationship is rare because so few people possess the necessary maturity.*

*Even casual observers know that this couple lives for something exciting.*

# IT REALLY IS

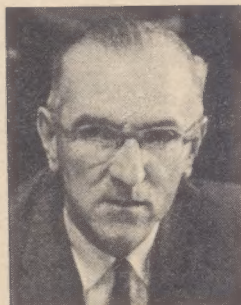
sisted by Mrs. Peggy Harroff, Cuber completed a three-year exploration of the marital experiences of 437 normal, successful, upper-middle-class men and women. Referring to his as-yet-unpublished study Cuber says, "I think we're nearer to what is true and honest in the lives of married people of this class than ever before."

Cuber, a friend and colleague of the late Dr. Alfred Charles Kinsey, expects a sharp and heated public reaction to his findings. "Many people will criticize our work as being indecent and immoral," he says.

"They'll condemn us for stirring people up. I expect to catch hell."

I am inclined to agree with this prediction after several discussions with Dr. Cuber and Mrs. Harroff

This is the first public account of the marriage studies now being readied for publication by Dr. John F. Cuber (right), Ohio State U. sociologist.



about their findings, of which these are some of the most arresting:

- Among "successful" marriages they found comparatively few "good" man-woman relationships ("good," here, means a deeply satisfying union which includes the sexual, social and intellectual aspects of marriage).



OF THE small proportion of good man-woman relationships, a surprisingly high number are carried on outside of marriage. Usually the man, the woman, or both are married to somebody else. The extra-marital relationship with "the other woman" (or man) often has many constructive qualities. These are frequently important, meaningful and central in the lives of the two people concerned. About half the time the other spouse is aware of the relationship, and often condones it. Wives who have an aversion to sex may actually welcome the arrangement. Often, the extra-marital affair does not include sex

yet it still retains its significance

- Hypocrisy, pretexts, euphemisms and rationalizations are widely practiced by one or both partners in "successful" marriages. According to the testimony of university, business and military executives, hundreds of malcontent husbands clamor for foreign posts to escape stultifying marriages. When this happens the wife usually saves face by explaining to friends that her husband is making the sacrifice of being away alone for the next two years for the sake of his career. Women whose husbands conduct extramarital affairs say things like: "Men are like that . . . His work is a strain . . . He's at a dangerous age."

- Sex behavior and attitudes vary greatly among the married. A great many males appear to be "washed up" at forty as far as building a vital and enduring sexual relationship is concerned. For many couples, sex becomes a predictable, brief, Saturday night encounter in which the parties concerned are anesthetized by alcohol. Some wives have referred to their sex lives as "legal prostitution, not much better than masturbation." Husbands have called their wives "legal, inexpensive, clean mechanisms for physical gratification."

"They have said, in so many words," says Cuber, "that the same purpose could be served by a prostitute, except for physical inconvenience, the cost and the health risk." Even with this quality of sex life, which is seriously substandard



## In spite of cynics, genuine love— the ideal of the romantic poets—is real.

in mental health terms, people manage to lead useful, productive lives. Some women (and the same applies to men) who were described to Cuber as “unaffectionate” and “frigid” by their husbands, have shown themselves to be vital and passionate in relationships with outside partners.

• Nearly all the man-woman relationships covered by this study clearly fit one of five categories. Dr. Cuber has coined names for them. In what he calls the *conflict-habituated* relationship, the couples are continuously quarreling, nagging, throwing up the past—or about to. “An atmosphere of tension permeates their lives together.” In the *devitalized* relationship, the union is apathetic, lifeless, void of zest. Equally as barren is the *passive-congenial* relationship, but here the man and woman lay great emphasis on the things they have in common.

The vast majority of marriages fall into these three categories. This has led the people concerned to the comforting conclusion that “this is the way marriage is and has to be, except for a few odd-balls and pretenders who claim otherwise.”

Cuber’s remaining two kinds of marriage account for only a small minority of all marriages. In the *vital* relationship, there is a vibrant, exciting sharing of some important

experience. The *total* relationship—the rarest of all—is like the vital, with the important addition that the partners share most or all aspects of life.

• In spite of cynics, genuine love—the ideal of the romantic poets—is real. Cuber discovered a number of such inspiring unions which survive and flourish well into middle age and even beyond. How do they happen? Why do they happen? Cuber doesn’t profess to have the answers. “A man has a good-looking wife who dresses well, talks intelligently, prepares delicious meals and keeps the kids out of his hair. Yet he’s only mildly interested in her. Then along comes some frowsy dame and the whole world lights up. There’s an alchemy of love about which we know nothing.”

All photos of couple P.I.P.—M.T.I.



• In a high proportion of marriages, communication between the man and woman is at an impasse. Although Cuber's subjects are educated, articulate people, many of them couldn't communicate with each other in a meaningful way. Even when these people "talked things over" at length, they didn't seem to reach each other. "The man and woman are reaching across an abyss so vast that they perceive only the vaguest outline of each other," says Cuber.



**R**OMANTIC love, as a basis of marriage among young people, is becoming very rare. Young men and women are "sensible" almost to the point of being businesslike in their approach to marriage. Instead of being swept off their feet by deep emotion and passion, they marry for "alien considerations"—that is, money, a home in the "right" neighborhood, the "right" school for their future children, the "right" family connection or a wife

who will live up to the public image of "an executive's wife." Such couples usually get what they were seeking in marriage, but the man-woman relationship in this class, within the union, atrophies. Cuber feels that most young couples are *too* sensible about marriage. "But," he says, "people no longer seem to trust their basic instincts and impulses. I predict in the future, an even larger proportion of unsatisfactory man-woman relationships."

• Marriage counseling, hampered by religious and moralistic taboos and lacking a foundation of reliable research, is of doubtful value. "I gave up my work as a marriage counselor because I was disillusioned about its effectiveness," says Cuber. Marriage counselors disagree even about what they're trying to do. One faction of the AAMC (the American Association of Marriage Counselors) believes that the institution of marriage must be preserved even if it means sacrificing the people concerned; another faction holds that the individual has a right to happiness and fulfillment, even at the expense of the marriage. Two years ago, when the incumbent president of the AAMC was divorced, an angry and vocal segment of the membership forced him to resign from office.

Much of the actual counsel they give is of doubtful value. "Togetherness," or doing things together, is advised for some couples who have grown apart. But in most cases these people *want* to be apart. "It's tragic," says Cuber, "when you



**"It's tragic when you have to consciously try to be a good companion."**

have to consciously try to be a good companion to the man or woman you're living with. 'Togetherness' is like an opiate. It may give symptomatic relief; but it will probably result in an addiction, not a solution."



**D**R. CUBER and Mrs. Harroff hope that their series of studies on marriage—of which this is the first—will help provide a realistic appraisal of the modern "man-woman relationship" problem. Much present information, which passes for research, he describes as "the damndest drivel." Sociologists and psychologists are highly trained in research and statistical methods. Using rigid questionnaires, they investigate a small fragment of a person's life and then publish it in statistical form. "The true and larger picture of life eludes them," says

Cuber. "They're incredibly innocent in their knowledge of the whole person."

Cuber favors a reportorial approach. You let the informant tell you, with complete freedom, what's important to him. Like the cultural anthropologist, you talk to the natives and find out what's really going on. "Sociologists and psychologists got into trouble when they stopped being people-watchers," Cuber says. Significantly, his research associate, Mrs. Peggy Harroff, is a highly sensitive, intelligent woman lacking an extensive background in social science research methods. "She's valuable to me because she hasn't been brainwashed," says Cuber.

Getting meaningful advice on a man-woman relationship is not easy. Dr. Cuber says sociologists and psychologists are too scientific and fragmentary in their approach. Doctors have an organic bias: they often don't recognize what they can't see in a test tube. Many psychiatrists have become enchanted by Freudian psychology which may or may not be pertinent. University and school courses on marriage tend to be unrealistic, hidebound and out of date. So do "how to" marriage books. (Recently a publisher refused to accept a book because the author suggested that some married couples would be better off without chil-

dren.) Lovelorn columnists, like most other advisers, are stout, moralistic defenders of present institutions. They tend to blame and castigate one of the marriage partners in the event of friction.

"There are no cowboys and Indians in marriage," says Cuber. "The villain is the relationship." The best that present-day counselors can do is to admonish people "to adjust, to be rational, to be realistic and not upset the apple-cart." This is fine advice for those who can accept it. But for desperate men and women trapped in torturous marriages and craving a satisfying man-woman relationship, such counsel has neither meaning nor comfort.



**B**Y IDENTIFYING the five distinct kinds of "successful" marriages, Cuber says he has made a first step towards understanding man-woman relationships. The 437 men and women he worked with were between the ages of thirty-five

and fifty-five, married for at least ten years, and contemplating neither divorce nor separation. They were "normal" people, not receiving help from a marriage counselor or psychiatrist. In income and education they were well above the average—presumably, therefore, people with above-average ability to engage in a satisfying man-woman relationship.

The men were conspicuously successful in their work — lawyers, judges, doctors, clergymen, legislators, military officers, university professors, artists and business executives. These people were the leaders in their communities. The Cuber and Harroff interviews were lengthy and intimate, some of them lasting an entire week. "We listened as long as our subjects had something worthwhile to say," says Cuber.

In presenting his five categories, Cuber emphasizes that they represent different forms of adjustment to marriage. Despite the stresses and strains, most people will continue with their union even though they find themselves a partner in a relationship as abrasive as the ones Cuber calls *conflict-habituated*. In most marriages, fights are sporadic and arguments tend to get settled. Not so with the conflict-habituated. At worst the couple spends a good deal of time at home quarreling and wrangling. At best, they manage to hold their tongues while out in public, but a few drinks too many and they may be at each others' throats. Rarely does the couple manage to conceal the real quality of their re-



## Devitalized couples rationalize: "There are more important things in life."

lationship from their children, their relatives or their close friends.

They will attend social and ceremonial functions with other people but will avoid being alone together at home whenever possible. They develop the habit of side-stepping certain controversial personal topics. They're reluctant to talk about their sex life because it's generally unsatisfactory. What love-making they do is often overlaid with hostility. "My wife's good in bed," said one man grudgingly, "but I can't stand the witch the rest of the time." Cuber observes, "These people have a colossal innocence of the possibilities of the man-woman relationship."

There's no spirited, open warfare in the *devitalized* relationship because of an all-pervasive apathy and lifelessness. Despite its numbness, the marriage is likely to continue indefinitely because there are so many pressures against divorce or philandering. The devitalized couple rationalize their positions by repeating. "There are other important things in life," referring to their children, property and family tradition. Wedding anniversaries and other occasions are celebrated elaborately if somewhat grimly. They'll reason that while their sex life isn't much, it's better than nothing and preferable to a clandestine affair. The husband is apt to refer to his

wife as "Mom" and describes her as "a good mother"; the wife calls her husband "Dad" and describes him as "a good provider." Such couples actually welcome middle age and the comfortable rut it provides.



THERE'S also an absence of open conflict in the *passive-congenial* relationship. "They tip-toe rather gingerly around a residue of subtle resentments and frustrations," says Cuber. Precautions to enforce the peace are as elaborate as a union-management contract. On a trip the woman's preferences will be followed one day; the man's on the next. They make a good deal of fuss about such common interests as boating, gardening, golf, skiing or horseback riding. Actually, these are devices to kill time together in

an impersonal way. When even this much propinquity begins to pall, the woman will go out on "a binge of community altruism." She'll become the spark plug of the Red Cross, Cancer Society or Home and School Association. The husband will retreat, nightly, to his study with a bulging brief case or take repeated business trips out of town — alone.

Why, then, do these men and women stay together? There are many possible explanations. The man finds some contentment with his career, his hobbies, and his male companions; the woman prizes her home, children and her place in the community. Despite the absence of excitement and lustre, one or both partners tend to refer to their relationship as "a good marriage."



ANOTHER factor which may perpetuate the union is the individual's particular orientation to life. Many people are "institution-oriented." They conform to society;

the marriage vows must not be broken. A good marriage, they feel, is not to be equated with personal happiness or self-fulfillment: "That's romantic nonsense for kids."

A more obvious reason that divorce is less frequent is that most people are bound in marriage by what Cuber calls "traps." There's the *ecclesiastical* trap: conscientious Roman Catholics eschew divorce. The *cultural* trap: by tradition. Jews as well as other groups hold sacred the cohesiveness of the family and the welfare of the children. The *economic* trap: most men can't afford to maintain two households. Even for the well fixed, a property settlement on the wife may seriously disrupt economic interests and investments. The *career* trap: society still penalizes, however subtly, the man who leaves his wife. Top posts tend to go to the man with the "clean" personal record. The *pride* trap: many people are prepared to endure a private hell rather than publicly admit that they have failed at marriage. Finally, there are people who are simply fearful and indecisive, too weak to embark on a new and unfamiliar way of life.

Separations and divorces, of course, do occur. They are more likely if one of the partners is "person-oriented," which is to say that he thinks in terms of self-fulfillment, self-realization and personal happiness. (Cuber speculates that communication is virtually impossible between an institution-oriented and person-oriented man and

**"I wish all men and women capable of  
a vital relationship would get together."**

woman. "What's important to one is sheer nonsense to the other," he says. "They can't talk because they can't agree on the ground rules. How useless to advise them to talk it over.")



**B**UT THE most dynamic reason for dissolving a marriage is the advent of an "engaging alternative." The man may meet a superior, attractive woman and, in time, he recognizes that a vital, fulfilling man-woman relationship is possible. His erstwhile marriage becomes revolting and "a living lie." He doesn't act impulsively: he's been around too long to alter his life drastically for the sake of a compelling but meaningless attachment. He moves after mature reflection. This is done, of course, at a cost, but he's certain that what he's getting is worth it.

Nelson Rockefeller, for instance, remarried at the possible price of the presidency of the United States.

But even the most engaging "other woman" (or man) is unlikely to impinge seriously on the relatively small proportion of man-woman relationships which fall into the *vital* and *total* categories. These are unions entered into by two adequate, vital individuals. Cuber says, "I wish that all the men and women capable of a vital or total relationship would get together and not snarl up their lives by getting involved with other people." Most adults, because of psychological and other impediments, are not capable of participating in a rich and full male-female union.

The following marriage meets Cuber's definition of a total relationship: The husband is an internationally known scientist. For forty years his wife has been his friend, mistress and partner. He still goes home every day to have a leisurely lunch and to spend a few hours with his wife at noon. They feel comfortable with each other, as they do with their four grown children. There are no areas of tension. The wife regularly reads non-technical literature in order to recommend enjoyable reading to her busy husband. She helps him keep his files and scrapbooks up to date. She invariably accompanies him to inter-



national conferences and helps him meet and entertain his colleagues because, by nature, he's a shy person.

The wife has played an important part in helping her husband achieve international recognition, a fact he freely and gladly acknowledges. After these many years, they still deeply enjoy each other's company.

Cuber has noticed that unhappily married people react immediately when vital or total relationships are described to them. "They sure pulled the wool over your eyes," is a common rejoinder. They'll often volunteer an anecdote about a supposedly idyllic marriage they knew of which ended in bitterness and separation.



ONE WOMAN was advised by her doctor to take an immediate vacation. She refused, explaining she'd prefer to wait until her husband could accompany her because everything they did together was such fun. The doctor regarded her

curiously. "That sounds like a neurotic symptom," he said.

What role does sex play in the lives of the upper-middle-class men and women Cuber has studied? While generalizations are difficult, Cuber perceived certain repetitive patterns. In general, the male-female sex cycle as described by Kinsey is confirmed. By the time the woman reaches the peak of her sex drive in her late thirties, the male urge has begun to decline.

"When I think of many of the men at forty, sexually," says Cuber, "the image of the eunuch comes to mind. He's not seriously interested in having a meaningful sexual relationship with a woman." Union with his wife has become sporadic and perfunctory. His last outside encounter probably took place several months ago. Chances are he was involved, only casually, with a secretary after the office Christmas party or with a call girl at an out-of-town business convention.

The woman's premarital experience often has a strong bearing on the nature of her sexual adjustment in marriage. As young girls, many women start with an eager, healthy outgoing attitude toward sex. An inexperienced girl may give herself to one or several men. After the experience of being jilted, or an abortion or illegitimacy, she recognizes that she's being exploited sexually.

She embarks on a less adventurous path: she "settles down" and marries "a sensible guy." Within such a union she is in complete control of her emotions which is one of

## When told of vital relationships, the unhappily married won't believe it.

the reasons she married the man. "Most bad marriages are made for the right reasons," comments Cuber. After a few children the woman often rediscovers that she's still a sexual creature. At this point, she can either have an affair or sublimate her sex urges by immersing herself in communal endeavors. Most women—probably eight out of ten—choose abstinence.

Much of the sexual activity in the less satisfactory forms of marriage is designated by Cuber as *raw sex*, i.e., sex without affection.



**I**N MORE complete relationships, sex is *affectional*. The union includes admiration, respect, affection; the couple love being together even when they're not in bed. With many couples, after the first few exciting years, affection rather than sex as-

sumes a greater significance. The man and woman are attached to each other emotionally, they make sacrifices for each other cheerfully, but they do not often meet in bed. This is not necessarily because of bitterness or hostility. The woman may develop an aversion to sex; poor health and low sexual energy on the part of one or both partners may play a part. "This is a classification of sexual relationships," says Cuber. "It is not a sexual classification of people." Indeed, many people are capable of remarkable versatility. A man may have affection without sex with his wife; raw sex with a strange woman he meets at a party; affectional sex with his office wife. A woman may have raw sex with her husband, affection with her music teacher and affectional sex with her lover.

What motivates a man (or woman) to seek a strange bed? Cuber's subjects gave him many reasons; they tend to vary according to the marriage category the individual belongs to. In conflict-habituated marriages, the man may go out on one-night stands with prostitutes or lower-class women simply as an outlet for hostility. "The women are objects of contempt," says Cuber.

In passive-congenial marriages, the man may stray for reasons of sheer boredom. In vital relationships, the man may stray because



he feels free to do so. He's emancipated. He regards new sexual experience as desirable, and his wife sometimes agrees. It is not regarded as a serious disloyalty or threat but something the loved one ought to be permitted to have. Moreover, a vital relationship, while often vital sexually, is not necessarily so. Both parties may regard other aspects of their relationship as more central to their unity.

Extramarital affairs vary in length, intensity and significance. In the affairs which last, Cuber has noted that "the other woman" is usually attractive, vivacious and vital. She knows how to dress and how to talk in a scintillating way. She's void of pretense, there's a freshness and frankness about her. Usually, she's the same age as the man and can be either single, married or divorced. "In every case," says Cuber, "there's an obvious and plausible reason why a man should be attracted." As for "the other man," he, too, may be single, married or divorced. In many ways he's the counterpart of the "other woman." He's a vital person, often a man of ideas and accomplishment.

In Cuber's view, many of these extramarital unions have constructive, positive features; in some cases, they may even help preserve a marriage. One business executive, for example, was party to a devitalized marriage. He was bored, miserable and depressed a good deal of the time. He felt trapped because his religious persuasion ruled out the possibility of divorce. Since

then he has formed a liaison with an attractive, superior woman. His entire life has improved. He's doing better at his job, he's happier at home and he spends time, cheerfully, with his children. The wife, not unexpectedly, does not approve of the affair, but she recognizes the benefits which have come with it.

A highly successful surgeon of fifty-two is one half of a stultifying marriage. For several years he's been having a succession of affairs, most of them lasting a year or so. He claims that these attachments refurbish his mind, spirit and body. "Without them life would be intolerably prosaic and dull," he says. Many psychiatrists would label this surgeon a neurotic. But, as in many similar cases, the charge won't stick. The man in question is emotionally stable, intelligent, efficient and successful by all ordinary standards. "The more you know of a person's circumstances," says Cuber, "the less inclined you are to make judgments about him."

ON THE basis of his findings, Cuber also refutes the accepted belief that men and women who engage in extra-marital affairs are burdened by a staggering load of guilt. "That's a lot of sentimental rubbish," he says. "In the men and women in this class, the guilt usually doesn't exist."

Another surprising finding that Cuber made is the large number of extra-marital affairs which are *not* sexual in nature. A woman of forty has had a lengthy and close friend-



**Cuber would like to investigate the alchemy of love. "I'd forsake all else."**

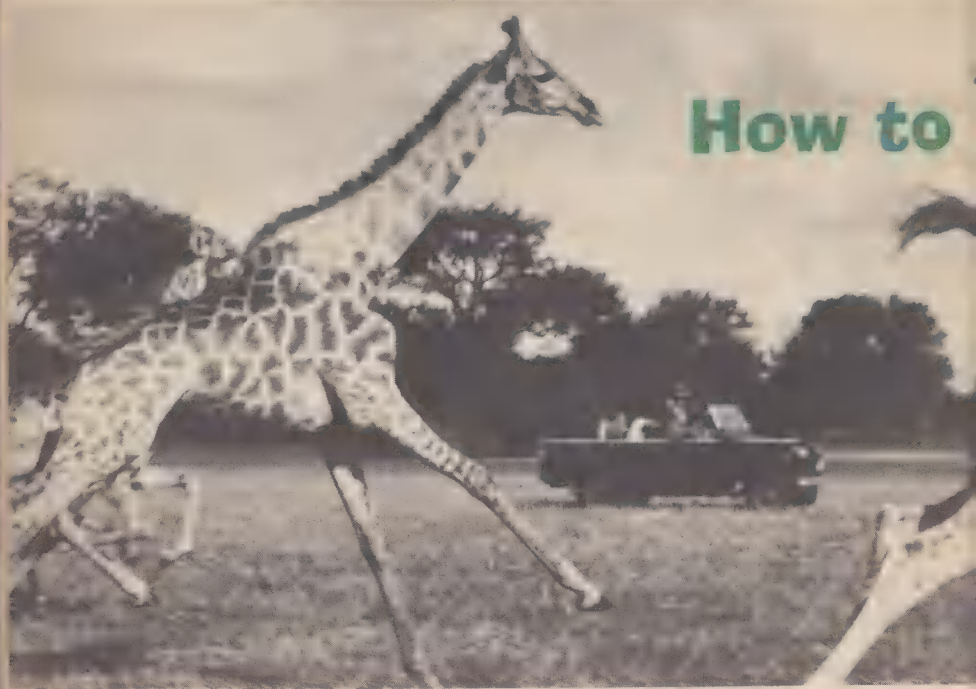
ship with a man of fifty. She periodically goes to see him and they talk about their problems and mutual interests. It's therapy for her since she can't communicate with her husband. Such significant non-sexual relationships commonly exist between doctors and patients, clergymen and parishioners, employer and office wife, and professor and student. "These people are meaningful to each other," says Cuber.

This survey of upper-middle-class "successful" marriages is only the beginning of a series of inquiries into man-woman relationships by Dr. Cuber and Mrs. Harroff. They plan to study the children of the men and women they've interviewed

—their expectations of marriage and how the marriages later turned out. Man-woman relationships after the age of sixty-five are of special interest to them. "We have reason to believe that many people just begin to live at sixty-five," says Cuber. They want to scrutinize the people in divorce, "a poorly understood, badly misrepresented minority."

Finally, Cuber would like to launch an elaborate investigation into the somewhat vaporous subject of the alchemy of love. "To do this job the way it deserves to be done," says Cuber, "I'd gladly forsake all other labors and take the oath of poverty."





## How to

Game re-stockers in a Land Rover single out one giraffe for capture from a herd.



The giraffe, a highly nervous animal, must be blindfolded by putting a blanket over its head, before it can be harnessed.

**T**O EARLY European settlers, Africa seemed to possess a varied and inexhaustible supply of game. They hunted its animals so relentlessly that many species were reduced to a point where they faced extinction.

Today, both Europeans and Africans have become more conscious of the reckless slaughter and are doing a different kind of hunting—this time, in an attempt to correct their earlier excesses.

The giraffe was wiped out in some areas because its flesh was good to eat and its tough hide proved to be

# catch a giraffe



all photos Three Lions

A "Rhodesian lasso" slipped around one of the animal's legs brings him to a stop.

excellent for such things as carriage reins. Now giraffes live in carefully guarded game sanctuaries.

Periodically, the smaller game reserves must be re-stocked; new animals are then brought mostly from Wankie National Park in Southern Rhodesia, one of Africa's largest and most easily accessible game sanctuaries.

Moving live giraffes from one place to another is no easy task. They are the world's tallest animals, standing as high as 12 feet at the shoulder. The neck adds an additional five to seven feet. Giraffes are



Harnessing and controlling giraffes is a gentle process, for despite their size, they are delicate animals and easily injured.





Finally controlled in a rail stockade at the hunters' camp, these animals await transfer to a new area where the giraffe population is low.

fast as well as tall. They can gallop at speeds up to 32 miles per hour. Usually, they travel in herds of about 20.

Despite its great size and hefty weight (an adult male may weigh as much as a ton and a half), the giraffe is not a really dangerous animal; like the cow and the camel, it is a ruminant and strictly vegetarian.

But if molested, it can make trouble. One blow of its hoof can behead a marauding lion. Its head (which weighs 100 pounds in the case of a full-grown specimen) can pack a terrific wallop if used as a battering ram.

The Chief Game Ranger at Wankie Park has devised a method of capturing giraffes that has been unusually successful.

Game preserve employees move in

on a herd of the animals in a Land Rover. They single out one of them and capture it with a "Rhodesian lasso." One end of the rope is secured to the car, and the loop of lasso is deftly slipped around the rear leg of the running animal.

The giraffe is then maneuvered into position and a blanket is thrown over its head to quiet it. Only then can the animal be harnessed.

Infinite patience is required for this operation, for a rough or hurried job would unduly tire or frighten the animal and giraffes are surprisingly susceptible to death from exhaustion and shock.

At the hunters' camp, the giraffes are corralled and later sent to new territories where they can establish new herds that will insure the survival of this remarkable beast.



## SST— Aviation's leap in the dark

Anglo-French Concorde is already in the works. Plane will be able to fly 100 passengers across Atlantic in three hours.

by James H. Winchester

The big nations of the world are all scrambling to be the first to build a commercial supersonic transport (SST).

Yet in the rush, they have overlooked two basic questions: Who needs it? Will it be safe?

THE airline industry today is in far more need of a passenger boom than a sonic boom. But politics and prestige make the introduction of a supersonic transport (SST) inevitable within the next decade.

The Anglo-French Concorde, designed to hustle 100 passengers from Paris or London to New York in three hours, is already out of the design stage. The tab for its \$450 million cost is being picked up jointly by the British and French gov-

ernments, with France's Sud Aviation, the British Aviation Corporation and Bristol-Siddeley, doing the developing and building. Reportedly, Russia is equally advanced in designing a supersonic transport.

The United States, admittedly behind schedule in this race, will announce the awarding of a design contract for its own supersonic plane and engines—expected to be superior in speed and passenger capacity to either the British-French



N.A.S.A.

Needle-nosed supersonic transport model at Ames Research Center, Moffett Field, Calif., shows sharp nose and swept-back wings, two characteristics of supersonic craft.

or the Russian entries—on May 1.

Development costs will be \$1 billion, or more. Airframe designs are being worked up by Boeing, Lockheed and North American Aviation, with engine designs by United Aircraft, Curtiss-Wright and General Electric.

Such world airline giants as Pan American, TWA, American Airlines, Air France, Continental, Japan Airlines, BOAC and Alitalia have already deposited millions of dollars to reserve space for themselves on both the Concorde production line and for the American supersonic, although the builder has not yet been determined. In fact, the crucial question of just how fast the U.S. supersonic airliner shall be is still up in the air. The Concorde, priced at \$10,000,000, will be in the 1,200-to 1,400-mile-an-hour class.

Its announced delivery date is 1970, or 1971, at the latest.

If the U.S. design is in the same speed range—but able to carry 163 passengers instead of the Concorde's 100—experts predict it could be delivered “shortly” after the Concorde. It would cost up to \$17 million. If the decision is for a 2,000-mile-an-hour model, built out of stainless steel or titanium to meet the greater heats generated at this speed, the cost will be some \$30,000,000 per plane and delivery couldn't be expected until the mid-1970s, at the earliest.

### Russia may be first

The Russian supersonic, said to be in the same size and speed range as the Concorde, may well be the first into the air, although no spe-





N.A.S.A.

Multiple exposure of Langley Research's SCAT-15 model shows sweep wing in six positions. In flight, only three would be used, with high sweep for supersonic cruise.

cific target date or cost has been announced by Moscow. It, like the Concorde, will be built of aluminum.

Despite these definite and advanced steps, and while everyone agrees that it is technically possible to build a 1,400- to 2,000 mile-an-hour passenger plane, many valid arguments exist that this is largely a leap into the dark, that supersonic commercial aviation is uneconomic, dangerous and unnecessary.

Foremost is the question of safety and reliability. In the past, new-type passenger planes, largely, have grown out of military aircraft developments. In the case of the supersonic transports, many entirely new features will have to be introduced without such pre-commercial-use testing. B.K.O. Lundberg, Director General of the Aeronautical Re-

search Institute of Sweden, summed up his feelings to what he calls "The Supersonic Threat" recently in the *London Observer*:

"... Another hazard facing the SSTs is structural fatigue. Friction of the air on wings and fuselage will produce aerodynamic heating and hence thermal stresses, also possibly 'creep.' These effects will be far more complex and difficult to predict than in the case of subsonic aircraft.

"Laboratory tests will be much more extensive, but will yet be of rather limited value. This is because when high temperatures are involved, the duration of exposure is significant.

"... The unprecedented multitude of radically new design features, the aerodynamic heating and the virtually ballistic speed will

make the unforeseeable risks incomparably greater. As they will dominate over the foreseeable risks, the SST safety level—contrary to the case of a new type of subsonic aircraft—can be assessed only by actual service experience.

"The present overall safety level in scheduled aviation is about one fatal accident in 300,000 hours of flight. Thus no clear indication of whether or not the SST safety level is of the same order can be obtained until a multiple of 300,000 hours has been flown. For reasonable confidence, at least 1,500,000 hours—or 50 SST's flying during their entire life of, say, 30,000 hours—will be required. In other words, the testing time will be over 10 years.

"Therefore, assurances that SSTs will be as safe as subsonic aircraft can be nothing but wishful thinking."

### Hot enough to cook with

Solving this critical heat and structural problem will be one of the most expensive factors in the supersonic race. The nose of the Concorde, for example, when it is flying at its designed speed of 1,450 miles-an-hour, will heat up to 306° F. The nose on a 2,000 mile-an-hour supersonic plane would heat to better than 600° F., hot enough to broil a steak.

Aluminum, the conventional plane-building material, would "fail" at sustained speeds of more than those planned for the Concorde. Stainless steel and titanium,

considerably more expensive, would be needed by a faster plane.

Then there is radiation. At 60,000 feet, the altitude at which the Concorde is designed to cruise, the air is filled with twice the radioactivity that present-day jetliners encounter at 35,000 feet.

### Exposure to radiation

This background cosmic radiation will not appreciably affect passengers, since actual time in the air will be only half what it is now for comparable trips. The dose will be smaller than they get in today's jets. It's a different story for the crews. They will spend nearly the same time aloft in the supersonics as they do in the jetliners. The danger to them will be higher than it is now.

Sporadic bursts of radiation from solar flares, as Lundberg points out, at altitudes above 55,000 feet are another matter of concern. "It appears," he says, "that passengers in an SST at these altitudes during the most severe solar flares might receive a dose of the same order as the maximum permitted for a radiation worker on the ground in the course of three months."

Radioactivity will pose special problems for women passengers or crew members aboard the SSTs. The foetus is highly sensitive to radiation, and even moderate doses should be avoided, particularly during the first months of pregnancy. The SSTs, therefore, may be unable to carry stewardesses because,

**A threat to women passengers? Radiation at the high altitudes at which SST planes must fly could be dangerous to pregnant women and special restrictions may have to apply to all women of reproductive age.**

as the International Commission on Radiological Protections warns: "... Special recommendations for pregnant women must in practice apply to all women of reproductive age."

Noise is another big supersonic drawback, according to the SST detractors. Any plane flying faster than sound produces shock waves heard on the ground as a booming noise, a phenomenon that can shatter glass windows and crack plaster walls. The SSTs, say experts, will trail a continuous sonic boom path 50 miles wide on the earth below.

In preliminary planning, Federal Aviation Agency officials, who will award the contract to build the U.S. supersonic, are calling for the new plane to climb to 42,000 feet before breaking the sound barrier, and then to a cruising altitude of between 60,000 and 80,000 feet. The same restrictions will apply to the Concorde, say its designers.

These compromises with the noise problem mean restricted passenger capacity, partial loss of the supersonic speed advantage, and high fuel consumption to get the plane quickly up to cruising altitude.

Airline officials are deeply worried, too, that many countries whose

own airlines haven't purchased supersonics, will use the noise problem as an excuse to keep those flying the SSTs from rumbling overhead.

All these arguments that supersonics will endanger passengers or disturb those on the ground are hotly refuted, particularly by the designers of the Anglo-French Concorde. They take particular offense at the comments of Najeeb E. Halaby, administrator of the FAA in Washington, D.C., who says that the Concorde engineers have not given enough thought to the problems of stress and strain encountered by planes traveling at supersonic speeds.

"The aluminum gets hot," Halaby says, "and it creeps. Instead of a fixed, solid, constant shape, it begins to creep a little like asphalt on a very hot day."

Dr. A. E. Russell, chief designer for the Concorde, says metal selected already has been used in building aero-engines, and can be trusted to stand up to the toughest buffeting demanded.

"We have so far tested over 10,000 types of alloy materials," says Dr. Russell. "Some of the materials have been tried without a break for 20,000 hours, and no sign of metal



**"Emphasis on supersonics comes at a time when the airlines could better devote more time and money toward filling existing aircraft," says one expert.**

fatigue was apparent," he points out.

The Concorde's designers also dismiss the radiation danger. They say that the only real danger would come from solar flares. These incidents, they maintain, happen only every two or three years, and could probably be detected in time for the airliner to dive low enough to miss them.

### **An economic misery?**

Making a profit with the supersonics, however, is much more of a worry to the airlines than the technical pitfalls. Civil Aeronautics Board Chairman Alan S. Boyd, among others, paints a gloomy picture, predicting that the advent of the SSTs threatens new economic misery for the U.S. airline industry. He states flatly:

"The plane that England and France are jointly developing, to be ready by 1970 or 1971, will be uneconomical to operate. U.S. airlines, even though they know it is a loser, may have to buy it in order to compete. If they do buy it, the Federal Government may have to subsidize their operating losses. If they don't, they may lose so much money from passenger defections that the Government will have to subsidize them

anyway," says Chairman Boyd.

What many industry and government officials fear is a wild scramble to buy supersonics. With airlines vying to obtain as many of the new planes as possible, and manufacturers trying to sell all they can in a hurry to get back their investments, carrier capacity tends to build up faster than seat demand.

The Federal Aviation Agency forecasts a world market potential of 216 American 2,000 miles-an-hour passenger planes and 125 of the slower, smaller Concorde by mid-1970. To fill all the seats they would offer, an assumption of an increase of almost 300 percent in free world air traffic by 1975 must be made. Experienced airline men say this just can't be done. William Littlewood, vice-president of American Airlines, cautions: "We could easily build more supersonic capacity than the world may soon need."

The supersonics will be much more expensive to buy and operate than today's jets, and at the same time won't carry as many passengers. "Previously, when we designed an airplane in this country, we did it to produce a lower seat mile," warns L. B. Maytag, Jr., president of National Airlines. "If

**"Let's get going on the job. . ." urges another.**

**"Time's a-wasting. If we stand back, others will get the business, the foreign exchange and the prestige."**

we do not do this with our SST we are in for real trouble."

J. F. Dempsey, General Manager of Irish International Airlines and President of the International Air Transportation Association, also hits the SSTs: "Emphasis on super-sonics comes at a time when the airlines could better devote more time and money toward filling existing aircraft. Rather than a super-sonic transport that would cater to a relatively few long range travelers, it would make more sense socially and economically to concentrate on economic short-to-medium range aircraft that would open up air transport to the multitudes waiting to avail it."

### **Race for prestige**

Despite such detractors, the supersonic era is without doubt coming, if only because their development has become a prestige symbol to the countries—Britain, France, Russia and the U.S.—who have entered the race to build them.

America's struggle to spur construction of a supersonic transport involves not only national prestige, but jobs, dollars and foreign exchange, all keyed to recapturing world leadership in an industry

which in the past has meant up to \$1 billion in net export sales annually.

It has been estimated that a supersonic plane industry could add up to 40,000 jobs to the U.S. economy. And at \$17 million to \$30 million a plane, the sale of super-sonics abroad could bolster U.S. trade surpluses and help the nation's gold drain.

**"The U.S. has no choice . . ."**

"Let's get going on the job of putting a Yankee supersonic transport into the air," urges C. R. Smith, President of American Airlines. "Time's a-wasting. If we stand back, others will get the business, the foreign exchange and the prestige. Let's quit beating around the bush and get ourselves a prototype to flight test." Charles C. Tillinghast, Jr., President of Trans-World Airlines agrees: "The U.S. has no choice but to proceed with all vigor to produce a superior supersonic transport. Survival of our international airlines is at stake."

It is against these promises and problems that the SSTs are today struggling to become more than paper airplanes, off the drawing boards and into the skies.



All photos Los Angeles Times News Bureau

Dr. Mayer, right, entertains, left to right, daughter Maria; son-in-law Dr. Donat G. Wentzel; Mrs. Catherine Mayer, mother-in-law; son Peter; and Dr. Joseph Edward Mayer at a family gathering at home overlooking the blue Pacific.

## At home with Maria Mayer

The first U.S. woman to win a Nobel Prize in science is a scientist AND a wife

AT 4 A.M. last November 5, a telephone ring shattered the quiet of a modern hillside home in La Jolla, California. Sleepily, an auburn-haired woman picked up the receiver. It was a long-distance call from a Swedish newspaperman.

Then she sat bolt upright, all of a sudden fully awake.

"I can hardly believe it," she gasped. "How wonderful! I really don't know what to say!"

That is how Dr. Maria Goeppert

A library is only one possible backdrop for California physicist-professor Maria Mayer. When she's not working, she likes to cook and tend her garden.





**"I've always wanted to meet a king," says**

**Nobelist Maria Mayer, who follows in the tradition of Eve Curie and her daughter, Irene Joliot-Curie.**

Mayer, 57-year-old Polish-born professor of physics at the University of California, San Diego, learned she had been selected to receive the 1963 Nobel Prize in Physics.

She thus became the 12th University of California faculty member to be so honored, the third of her sex to be named in a science category, and the first American woman to win the coveted award in the field of science. Preceding her by half a century had been Eve Curie and her daughter, Irene Joliot-Curie.

Dr. Mayer woke up her husband to tell him the good news—Dr. Joseph Edward Mayer, a noted chemist himself. The happy couple celebrated at dawn by popping a bottle of champagne. Soon congratulations began to pour in and they continued for several days—telephone calls, telegrams, special delivery letters, visits from friends.

### **She gets her wish**

When she realized that she would have to fly to Stockholm on December 10 to receive the award from Sweden's King Gustave VI Adolf, her response was a cheery:

"Good, I've always wanted to meet a king."

Dr. Mayer shares the \$51,158 prize money with two others—Dr.

Eugene P. Wigner, Hungarian-born physicist at Princeton, and Professor J. Hans D. Jensen at the University of Heidelberg.

Dr. Mayer and Professor Jensen were honored for developing the so-called "shell model" theory of the atomic nucleus which some scientists regard as the single greatest advance in theoretical physics since World War II. Independently of one another, they worked on the theory in 1948 and 1949—she in the United States, he in Germany.

Up to that time, scientists had pretty well understood how the atom itself works. Tiny electrons spin around the nucleus like planets in the solar system circling the sun. They move according to precise mathematical laws. But what about the nucleus? How are its protons and neutrons arranged? Do they move? Why are some nuclei unusually stable?

One day Dr. Mayer was discussing these puzzlers with Dr. Enrico Fermi, chief scientist of the Manhattan Project, at the University of Chicago. The telephone rang. As he left to answer it, he remarked over his shoulder:

"Incidentally, is there any indication of spin-orbit coupling?"

With pencil and paper she started figuring furiously. Within 10 min-



"For my kind of physics, all I need are pencil, paper and a slide rule," says Prof. Mayer. She comes from a family that has been devoted to teaching and science through seven generations.

utes she had worked out a mathematical model of the nucleus and its parts.

"Everything just fell into place," she said.

Previously, scientists had visualized the atom's dense nucleus as a cluster, or as a liquid drop. The Mayer-Jensen "shell model" theory pictures the positively-charged protons and the electrically-neutral neutrons arranged in layers or shells. In essence, the mechanics of the nucleus are much like the atom itself.

This new look at the atom's nucleus, as Dr. Mayer once described it, "is like the delicate shells of an onion with nothing in the center."

Another time, trying to explain to her daughter the nucleus and the movement of its particles, she compared them to a waltz.

"If you've ever waltzed . . ."

"If you have ever waltzed," she said, "you know it is easier if each couple whirls in the same direction that all of the other couples are circling the dance floor. It is the same in the nucleus. Each particle spins in the same direction that all are travelling in their orbits."

The Mayer-Jensen theory holds that the most stable nuclei consist of certain magic numbers—2, 8, 20, 28, 50, 82, and 126. A nucleus is called magic if either its protons or neutrons add up to a magic number. If both protons and neutrons are magic numbers, the nucleus is double magic—and unusually stable. For example, the helium nucleus, with two protons and two neutrons is extremely stable. So also is oxygen, with eight protons and eight neutrons. Calcium, with 20 protons and from 20 to 28 neutrons, is still another example.

One frivolous physicist even composed a little ditty to describe the new theory:

*Two neutrons go together, or  
eight of them,  
Or 28 or even 82 of them.  
Just ask Mrs. Mayer for  
The why and the wherefore. . .*

After Dr. Mayer had published her theory in *The Physical Review*, she learned that Professor Jensen had developed a similar theory. In





Dr. Joseph Edward Mayer, himself a noted chemist, stresses Maria Mayer's wifely qualities, thinks of her as a scientist second.

the summer of 1951 they collaborated on a fuller explanation and mathematical proof in a book, *Elementary Structure of Nuclear Shell Structure*. They dedicated it to "Our most patient and most constructive critic, Joseph Edward Mayer."

At first many scientists were skeptical, but one by one they accepted

the new "shell model" theory. Now *Elementary Structure of Nuclear Shell Structure* is used as a supplementary text in the toughest college physics courses.

Maria Goeppert was born in Katowitz, Poland (now a part of East Germany) on June 28, 1906. She represents the seventh generation of a family devoted to teaching and science. Her father was a professor of medicine, while her mother taught languages and music.

### Physics was a challenge

Red-haired Maria attended the University of Gottingen for six years where she earned a Ph.D. degree and the title of "Beauty of Gottingen." While there she studied with two physicists who had already won the Nobel Prize, James Franck and Adolph Windaus, and with another who was to win it later, Max Born.

"Mathematics was merely puzzle-solving," she remembers. "Physics was the real challenge."

It was at Gottingen that she met and fell in love with an American—Dr. Joseph Edward Mayer from the University of California who was doing post-graduate work. They were married January 18, 1930. She was 23, he was 25.

That fall, Joseph received an appointment to teach chemistry at Johns Hopkins University and settled his new bride in Baltimore. Maria taught physics, became a naturalized citizen and started a family.

A daughter, also named Maria,

**As a student, red-headed Maria won title "the beauty of Gottingen," studied physics with Nobelists.**

**Here she combines a family, teaching, and a slide rule.**

was born in 1934, and a son, Peter, in 1939. Maria was graduated from Ripon College, studied for two years at the University of Heidelberg and is now married to Dr. Donat G. Wentzel of the University of Michigan. Peter earned a bachelor's degree at Cal Tech, then "strayed" from science to study graduate economics at the University of California, Berkeley.

The Mayers—Joseph and Maria—continued to teach at Johns Hopkins all during the 1930s. When Joseph received a wartime appointment at Columbia University in 1941, they moved to Englewood, New Jersey, and Maria taught at Sarah Lawrence College.

She admits to one bit of professional absent-mindedness during this period. It occurred one morning when, like a good wife, she drove Joseph from their apartment to the train station.

After he had boarded the commuter special, she went on to Bronxville and Sarah Lawrence College. Suddenly she realized she was still in her bathrobe—a garb hardly suitable for teaching mathematics or physics.

"Even in a girl's school," she laughs.

Following World War II came another move—this time to the Uni-

versity of Chicago, where Joseph was appointed professor of chemistry and Maria professor of physics. She also served as a senior scientist of the nearby Argonne Laboratory, supported by the Atomic Energy Commission. It was in Chicago that she postulated the "shell model" theory.

Finally, in 1960, the husband-and-wife scientific team joined the new School of Science and Engineering at the University of California's Scripps Institution of Oceanography—since then renamed the University of California, San Diego.

### Succession of honors

A year before she won the Nobel Prize, Dr. Mayer's eminence in the world of science was recognized by the *Los Angeles Times* which named her a 1962 "Woman of the Year."

At UC-San Diego, Dr. Mayer teaches theoretical physics to a small group of students, conducts her own research ("For my kind of physics, all I need are pencil, paper and a slide rule," she once said), and runs a tidy household for herself and her husband.

"Physics doesn't attract many women," she said not long ago. "They may have a fear of the mathematics involved. All who en-

ter this field, of course, must understand mathematics completely.

"It is not a field, such as history, that can be learned in segments. Physics requires that you must know all the elements of mathematics, from the elementary level on up.

"And it is a sad thing, too, that more of our capable graduate students are not going into teaching. The monetary attraction outside the profession is still great."

The Mayers live an informal, relaxed life. They enjoy their children who visit them frequently. On weekends, they sometimes go for long drives in southern California. They have many friends in the community. "Whenever there's a party," said one of the faculty wives, "the

men seem to collect around Maria."

The Mayers' home, which they built in 1960, overlooks part of the UC-San Diego campus—with a breath-taking view of the blue Pacific beyond. There she pursues two hobbies, cooking and gardening.

"I like to work with my hands," she says, "to give my brain a rest."

At a press conference on the morning of November 5, the Mayers were standing arm in arm on the grassy lawn of the UC-San Diego campus. A newspaperman asked Joseph whether he thought of the Nobel Prize winner at his side as a wife or as a scientist.

He looked around, startled, and answered, "Why a wife, of course, and a very wonderful one."

### *Don't get a toothache in Russia*

A SPECIAL U.S. dental mission to the Soviet Union has reported back that routine dental treatment in Russia is "primitive" and far behind dentistry in this country.

Some of the findings: "As a general impression, operative dentistry in the Soviet Union is primitive; prosthetic dentistry (dentures, bridges), acceptable; orthodontics (straightening of maligned teeth), crude and dangerously haphazard; oral and plastic surgery, excellent; pedodontics (children's dentistry), seriously handicapped by inferior operative dentistry; periodontics (treatment of gums and supporting tissues), almost devoid of debridement and curettage techniques; basic science training, fair to adequate."

Among the problems listed by the doctors: trained dentists are in short supply, with one dentist for every 5,000 people, as compared to one for 1,900 in the U.S.; most dentists have only a semi-professional education; local anesthesia is rarely used in routine treatment; steel is used rather than gold or other precious metals; 75 percent of Russian dentists are women; dentists are paid less than skilled workers.

The report adds: "... The Soviet Union must still catch up with the achievements of American dentistry in the last 25 or 30 years before it will be in any position to match the current status of dental science and dental health care in the United States. . . ."



Space scientists devising life-support systems for astronauts know that, distasteful as it may sound . . .

## You can live on your waste

**A**STRONAUTS on long space voyages will be the most spectacular misers of all time.

But instead of hoarding string and crusts of bread and old newspapers, the spacemen will save such commodities as their breath and their perspiration.

The spacemen will conserve everything—literally—in their spacecraft. This will be necessary, General Electric scientists say, because

expendable supplies for long voyages would be much too heavy and bulky to be stored in the spacecraft.

Enough food, water, and compressed air to sustain a crew of four on an eight-month trip to Venus, for instance, would outweigh the spacecraft itself.

This means that long-distance spacemen will have to drink and re-drink the same water, over and over

This device is making drinking water out of urine in experiments at General Electric's Space Technology Center. The liquid is vaporized and impurities are strained out.



**People have been re-drinking water for centuries. Today's water has the same elements as when the dinosaurs drank it and wallowed in it.**

again. They will have to breathe and re-breathe the same air as long as the trip lasts. And, in essence, they will have to eat and re-eat the same food.

Sounds distasteful? Not really, according to General Electric's space scientists working on "closed ecology"—the creation of an earth away from earth.

There is a vital interdependence between plants and animals on earth. For instance, plants need carbon dioxide for growth. They can get it from the exhaled breath of animals and humans. At the same time, animals need food which they can get by eating the plants.

In the "closed ecology" of earth there is a continuing cycle of using and re-using the resources available. In the long run, nothing is ever really thrown away.

### **From sewer to reservoir**

The water that runs down the sewer pipe eventually to the river and the ocean, comes back to us in the form of rain to fill our reservoirs.

The CO<sub>2</sub> of our exhaled breath comes back to us in the carbohydrates produced by plants which soak up carbon dioxide and combine it with hydrogen (obtained

from water) by photosynthesis.

Other natural cycles such as these go on continuously without our ever thinking about them. And we never receive any replenishment from outside the earth—except for energy from the sun.

Studies at General Electric's Space Technology Center in Valley Forge, Pa., indicate it will be practical to create a miniature, self-supporting earth away from earth in which astronauts will be able to survive—even thrive—for very long periods without replenishment of a single molecule of food, air or water from earth.

J. J. Konikoff who has spent several years investigating and experimenting with the problems of supporting life on lengthy space voyages believes that a closed space ecology can be ready for use in less than three years.

Drinking the same water again and again may seem repugnant, but Konikoff points out that it doesn't make any difference where it comes from—water is still H<sub>2</sub>O. As long as it is purified properly there is no problem. Besides that, people have been re-drinking water for centuries—water made from the same elements present on earth when the dinosaurs drank it and wallowed in it.

Long-range space vehicles thus will have to recapture every molecule of moisture in the spacemen's breath and perspiration, as well as other body wastes, and reprocess the water for drinking.

The means of purification will include distillation plus a technique known as catalytic oxidation which takes advantage of the readily available vacuum of space. Toxic portions of the waste liquid are broken down by catalytic oxidation into simple elements which then are used in other portions of the closed ecological system.

### Space farming

The astronauts' oxygen supply will be replenished by photosynthesis in which plant life absorbs carbon dioxide (exhaled by man) and gives off oxygen plus carbohydrates (food).

This will take place in a "space garden" carried in the spacecraft in which algae will take the place of string beans, corn and lettuce. All that is required to make this system work is the sun's energy, without which, of course, farms on earth don't bloom.

Scientists know that chemically and nutritionally the system will work—that is, enough food and oxygen will be produced by the algae to sustain human-life. As for taste, it's likely that a number of palatable flavors can be developed to provide some variety in what may be a hum-drum life in space.

Solid wastes left over from the

various processes including water purification will be treated in a sludge tank that will produce additional carbon dioxide, water and nitrogenous material. The sludge plus some additional or auxiliary algae will be used in a biochemical fuel cell to produce electricity to run equipment in the spacecraft.

The small amounts of nitrogen will be put to work in the photosynthesis of carbohydrates, while the CO<sub>2</sub> and water will be used in cycles mentioned earlier.

Variations of this completely closed system are being developed for trips of intermediate length. On a moon exploration, for example, it would probably be more practical to use a "partially closed ecology."

In such a case, air and water could be purified and reprocessed by the means described above, while enough food for several weeks could be taken without using too much space or adding too much weight.

### Nothing is wasted

Konikoff emphasizes that his closed space ecology is based on known principles and equipment which for the most part have been tested and proven. Chemically, it's a complex series of interrelated equations that combine hydrogen, oxygen, carbon and nitrogen in an extremely delicate balance.

Nothing is left over. Nothing is wasted. Nothing, except energy from the sun is added. And it all comes out even.





Starting school with a smile. The school these students are attending is making a round-the-world voyage. It's not all play—there are six days of classes a week.

## The university that

Stewards help students keep their cabins ship-shape. Accommodation costs range from \$1,590 per semester in a six-berth dorm to \$1,990 for share of a two-berth outside cabin.





all photos Schiff (Three Lions)

## went to sea

**This may be  
the grandest  
educational idea ever**

The University of the Seven Seas (below) slips away from port to begin its round-the-world cruise. The captain of this unusual ship (right) will chart its course to 17 countries.









THE top and only school in the seaweed league is the University of the Seven Seas, a 12,574-ton cruise ship converted into a college.

She carried 275 students on her first four-month voyage, ending this month in San Diego, after cruising around the world and touching at ports in 17 countries. Two days after docking, she will pick up another class.

E. Ray Nichols (above), executive director of the university, stresses that this is not just a pleasure cruise. Classes are taught six days a week in classrooms that have been carved out of the old pleasure ship's party areas (left).

When the ship is in port, there is field work involving conferences, lectures and interviews with local leaders in government, business, education, religion and the arts. Tuition is \$400 plus cabin fees (see previous page).

What is the attitude of other educational institutions to this unique experiment? Says Dr. Nichols, "They're looking at us like a tree-ful of owls."

## A priest looks at evolution



ONLY a little over a century ago, scientists pictured the universe as a perfectly ordered machine that had been set in motion at the beginning of time and would purr on like a Rolls-Royce until the end of time. Nothing ever seemed to change.

Then in 1859, Darwin proposed his theory of evolution, which seemed to show that life was always changing. Forty-six years later, Einstein seemed to prove that "it's all relative." Then came Heisenberg with his uncertainty principle,

which seemed to say we could never know anything for sure. Our mental image turned from a static world to one that was always changing, with nothing permanent, not even morals and religion.

A Catholic priest, Father Raymond J. Nogar, calls a halt to this trend in his book, *The Wisdom of Evolution* (Doubleday & Co., Inc., New York. 408 pp. \$5.75). Biological evolution is a fact, he agrees, (and reviews the reasons why) but: Evolution and the idea of change have been stretched far beyond their scientific meanings. They have become the basis for ways of thinking and rules for living—evolutionism, historicism, existentialism and dialectical materialism—to justify shifting moral standards and theology.

Within its scientific limits, says Father Nogar, evolution is compatible with Christianity. The Bible deals with religion, not science. Its story of creation is in the language of literature and poetry, so there is no clash with the proved scientific facts. There is still room for God, the Creator, who works through natural laws.

What about the connection between man and the Everlasting? Here's how Father Nogar views it:

The human species evolved about a million years ago, according to science. The physical changes were slow, but the transformation to man was instantaneous at the moment God gave the body a soul as well as supernatural powers, which man later lost by sinning—*B.H.F.*



P.I.P. photo by Jeep Hunter

by John and Molly Daugherty

**A**<sup>N</sup> International Hydrological Decade will begin January 1, 1965. Scientists from 100 nations will gather to study data on the water cycle and the distribution of water. Projects they begin may continue 100 years. It'll be quite a drip. Are you ready for it?

1. Aside from the water you drink or get in your food, how much water does your body form daily?
  - a. Three tablespoonfuls
  - b. Two cupfuls
  - c. One quart



2. What property of water is vital to your digestive system?
  - a. Its ability to dissolve many substances
  - b. Its ability to evaporate
  - c. Its high surface tension
3. When you drink a glass of water, you drink:
  - a. Single molecules of water
  - b. "Heavy" water
  - c. Clusters of water molecules
4. What property of water allows your body to absorb unusual amounts of heat without raising its temperature to an excessive degree?
  - a. Its small density
  - b. Its high specific heat
  - c. Its small coefficient of expansion
5. Why is perspiration so effective in cooling off your body when it's overheated?
  - a. It has a high heat of vaporization
  - b. It has a high specific heat
  - c. It is a poor conductor of heat
6. Insects such as water striders can skim across a pond without getting their feet wet because of the principle of:
  - a. Capillary action
  - b. Surface tension
  - c. Osmosis
7. Which of the following minerals is now gotten extensively from sea water?
  - a. Potash
  - b. Gold
  - c. Magnesium
8. Ice forms on top of the lake instead of the bottom because:
  - a. Water is densest at 39°F.
  - b. Water is densest at 32°F.
  - c. Water contracts steadily as it cools
9. Gravity pulls all substances down, but water can rise against gravity because of:
  - a. Latent heat
  - b. High specific heat
  - c. Capillary action

### Answers:

**1 - b** About two cupfuls. Although you drink water and get it in your food, your body itself forms it as a byproduct of chemical oxidation.

A good steak, by the way, is 60 percent water!

**2 - a** No other common liquid dissolves such a wide variety of materials as water. Food substances must dissolve in order to pass in and out of the cells of your body. The process by which food nutrients enter your cells and by which waste products leave your cells is osmosis.

**3 - c** You drink agglomerates or clusters at ordinary temperatures. The water molecule is a dipolar molecule with the hydrogen atoms attached to the oxygen at an angle of 105°. The imbalance in electrical charge makes the water molecules link up in clusters. In a cup of hot tea, however, the clusters tend to break up into single molecules.

It takes the distillation of 250,000 glasses of water to make one glass of "heavy" water (two atoms of heavy hydrogen—deuterium—to one of oxygen, or D<sub>2</sub>O).

**4 - b** Its high specific heat. It takes more heat to raise the temperature of water one degree than it takes to raise the temperature of any other common substance a degree. The specific heat of water is one calorie per gram per degree Centigrade, whereas iron is .11. The temperature of iron rises about nine times as

much as water's when an equal amount of heat is absorbed.

Your body contains 75 percent or more of water—much of it in chemical combination with other substances.

**5 - a** It has a high heat of vaporization. About 540 calories are needed to evaporate one gram of water ( $\frac{1}{454}$ th of a pound). This is much greater than the heat required to change most common substances to a vapor. For example, alcohol requires only 208 calories a gram; mercury, only 68.

To evaporate perspiration, the 540 calories per gram come from your body, thus cooling its surface.

**6 - b** The surface of water, stretched like an invisible membrane, is under tension. Some insects aren't heavy enough to break through this film of water molecules. The surface tension of water is greater than that of any other common liquid.

**7 - c** Scientists obtain magnesium from sea water with techniques learned from extracting bromine. Chemically treating sea water to produce magnesium hydroxide is the first step.

The gold content of the sea is fabulous, but gold particles do not dissolve in water and are difficult to separate. No experimental method so far is economical enough to use to extract the gold.

Potash can be extracted from the sea, but deposits on land are usually adequate.

**8 - a** Water is densest at 39°F. There's no substance like water! Most substances expand when heated and contract when cooled. Water contracts when it cools only until it reaches about 39°F. Then it expands until it reaches 32°F, its freezing point. The denser water (39°F) sinks to the bottom and stays there. The cooler, less dense water approaching 32°F stays on top and freezes. The ice stays on top because it's less dense than water.

**9 - c** By capillary action, water underground can rise through fine channels in the soil a few feet to the surface. Capillary action arises from adhesive and cohesive forces between molecules. The adhesive force of water causes water to cling to the sides of the channels, and cohesive forces between water molecules draw up others.

You demonstrate this principle when you dip the corner of a sugar cube in your tea or when you fill your capillary action fountain pen just by dipping it in a bottle of ink.

---

### Score yourself:

**8 - 9 right:** You're all set for the Hydrological Decade!

**4 - 7 right:** You know that, "water, water is almost everywhere."

**0 - 3 right:** Your water knowledge is all wet.



These children may represent the last generation of the unique El Molo tribe of Kenya. Malnutrition is hindering the ability of El Molo women to bear more children.

# The strangest

Fish from the alkaline waters of Lake Rudolf are the sole source of food for the tribe. Most of the fishing is done with iron-tipped harpoons from crude palm trunk rafts.







Heads of the El Molo harpoons are fashioned from soft iron bought from neighboring tribes. The tribe also uses nets to get larger catches in shallow water.

## Africans

All photos P.I.P., AFRICAPIX

THE Northern Frontier District of Kenya is one of the cruelest places in the world. The burning sun heats the ground to a temperature at which no plant life can survive. Only the alkaline waters of Lake Rudolf can support some fish.

On the south-eastern shore of this lake lives the El Molo tribe, the strangest of all African tribes. Its members are unique because, as far as can be determined, they are related to no other tribe in East Africa.

Their homes are tiny structures of palmleaf, driftwood and stones. Their diet consists solely of fish.

They have never known meat, milk or vegetables.

How the tribe manages to survive today with none of the foods considered by doctors to be essential to life, nobody knows.

But one thing is known. The Molos will not survive much longer unless something major is done for them. They have been reduced to a band of less than 200.

Every member of the tribe is a victim of malnutrition in its worst form. The women hardly have the strength to bear children.

Knowing they faced extinction,





Despite extreme poverty, tribe members have quantities of ornate jewelry as worn by ■ young El Molo girl (left). An El Molo home (above) is built from palmleaf, driftwood and stones found near the shore of Lake Rudolf. The surrounding countryside, of volcanic rock, is totally barren because of the scorching heat of the equatorial sun.

the tribe people recently pooled all their meagre possessions to buy a strong and healthy Samburu girl to be the wife of one of their number. But without improved conditions, even this desperate effort is doomed.

The government of Kenya has repeatedly tried to persuade the tribe to move to a more hospitable area, but they have steadfastly refused to leave their home, which they regard "a treasure house of basic human needs."

As a result, the government and

some charitable organizations have planned to send supplies.

Father J. P. Bordenet of the Roman Catholic Relief Services in Kenya announced a plan by which the tribe would receive a balanced diet for a year. Under the plan, each member of the tribe would get 20 pounds of food a month.

But regularly transporting food to this isolated area is no easy task, and whether the Molos can be saved from joining the extinct peoples of history remains in doubt.



## Inventor of the month

### The machine that reads writing



Leon D. Harmon's invention is a machine that reads handwriting.

BY INVENTING an apparatus that reads handwriting, Leon D. Harmon has significantly advanced man's ability to give orders to his slave, the machine.

Equipment already available could make out printed, typed, or even hand-printed letters and figures—for example the apparatus that reads the

codes on credit cards. *Science Digest's* Inventor of the Month tackled the tough problem of cursive script, in which one letter flows into another.

The reader he recently patented has proved to be 95 percent accurate with the script of various persons, provided it is carefully written. The tests were made in the computing and informa-



New Navy anti-submarine missile ignites under water, and then travels at supersonic speed through the air to the target area, where it sinks, and detonates.

tion research center of Bell Telephone Laboratories at Murray Hill, N.J., where the inventor is a member of the technical staff.

The machine notes the distinctive features, such as dots, crosses, slashes, cusps (points), closures (like the top of an o), retrograde (back) strokes, and height and depth. It groups the features and compares them with those in its memory to guess the letters. It must also chop the letters apart.

Many of the machine's own errors are corrected by the context—the probability of adjacent letters. For instance, it knows that q is generally followed by u, and that the letter following br is more likely to be a vowel than another r.

As with the simpler machine that Harmon made in 1959, the operator uses a captive stylus whose movements are sensed and transferred in electric pulses to a tape. The ultimate output may be in typewritten

form or in electronic language intelligible to machines.

The early model had a vocabulary of only 10 simple words—the numbers from one to zero, spelled out. The new one takes in the whole alphabet.

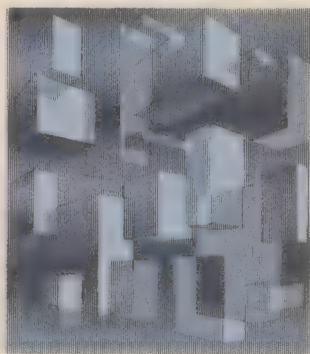
Harmon did not actually build his later model, but "computerized" the invention. That is, he proved by simulation what it would do, without incurring the expense of actually making the elaborate equipment.

Although he regards the improved apparatus as the first major step toward reading script, the inventor does not expect any early commercial application. His patent (3,111,646) is assigned to Bell Labs, the scientific research unit of the Bell System. For telephone companies, reading machines could help in translating toll tickets, processing bill stubs, and handling orders for changes in service.

—Stacy V. Jones

## Enemy subs, beware

IN THE ocean depths, the missile was launched horizontally from a submarine's conventional torpedo tube, and traveled a short distance in the water. Then its rocket motor ignited. The missile lifted itself out of the water and into the air, building up to supersonic speed. As Navy brass watched closely, the rocket motor separated from the flying depth bomb, and the bomb, directed by its guidance system, continued along its trajectory toward its target. Then it re-entered



**INVENTIONS  
PATENTS  
PROCESSES**

the water, sank and detonated at a prearranged depth.

That was how the Navy's newest and best anti-submarine weapon, SUBROC, was tested in the Pacific by the nuclear submarine *Permit*, sister ship of the ill-fated *Thresher*. The *Thresher* was the first ship of its class equipped to carry the SUBROC weapon system.

The Navy thinks so highly of its new weapon that, according to Rear Adm. W. T. Hines, deputy chief of the Bureau of Naval Weapons, the United States is building 25 fast, nuclear-attack-type submarines "capable of seeking out hostile submarines and destroying them with SUBROC missiles."

The idea of an anti-submarine missile launched underwater was conceived at the Naval Ordnance Laboratory, White Oaks, Md., several years ago, and Goodyear Aerospace Corp. has been prime contractor for development of the system.

SUBROC's speed places it on target before the enemy can take evasive action, Goodyear Aerospace president T. A. Knowles points out. A lightweight inertial guidance system using a thrust vectoring system directs the missile toward the target area. At a pre-determined range, rocket motor and depth bomb warhead are separated by a thrust-reversal and mechanical disconnect system. Then the depth bomb's guidance system steers it with aerodynamic fins.

The SUBROC has established two important firsts in the field of

submarine warfare. It is the first supersonic anti-submarine weapon launched under water and it is the first missile to use a rocket engine underwater.

The Navy feels that effective submarine destroying systems are of major importance. It has not forgotten that though Germany had only 57 submarines at the start of World War II and never had more than 325 operational at any time, nearly 3,000 allied merchant ships were sunk by them.

### Outdoorsmen only

A two-wheel drive vehicle that can speed along a sandy beach, plow through a swamp, scamper up a snowy mountain, or float across a lake, is being offered by Rokon, Inc., Box 280, Wilmington, Vt. If

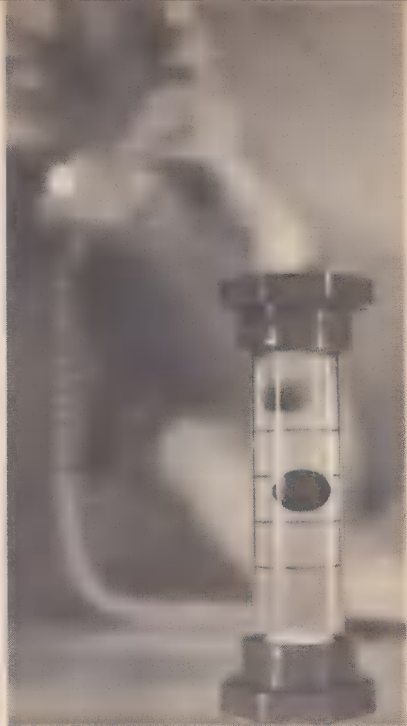
Rugged outdoor vehicle is designed for sportsmen, doesn't stop for a puncture.



you want to, you can even ride it up the front steps of your home.

The 185-pound Trail-Breaker, Mark II is strictly for outdoorsmen. The rugged 10 hp. vehicle is capable of hauling big game out of rough terrain. It is built to take 1,000 pounds of stress on its wheels and tires. Not even a puncture will stop it, as the low pressure implement type tires will support both the rider and machine with no air in them.

The vehicle is equipped with both front- and rear-wheel drive. A two-gallon fuel tank allows up to eight hours of continuous operation and the light-weight aluminum, drum-type wheels can be used to carry nine gallons of fuel or ballast. When empty, they serve as flotation tanks in mud or water. The manufacturer is Nethercutt Industries.



Pellet floating in silicone fluid, ■ modern version of the hourglass, marks time during long distance conversations.

### How long is long distance?

For the inveterate phone chatter, a new form of the old hour glass offers a delicate reminder that time is flying. The Ball-A-Float Phone Timer utilizes a silicone fluid to float a small colored plastic ball which, depending on the particular model, either rises or falls when the timer is inverted. When the ball reaches the other end of the clear plastic cylinder that holds it, the user knows time's up.

Timers come in three-minute and five-minute models, and special models measuring up to 25 minutes. It is designed for company gift-giving, and a special company mes-

sages can be imprinted on it. Available from Exclusive Products Co., 515 Broadway, Albany, N.Y.

### Dummy astronauts

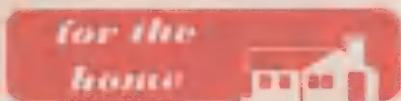
NASA's Manned Spacecraft Center will be partly manned by artificial astronauts. Modelling the latest in space suits will be two remote-controlled dummies with actuators for muscles, servo valves serving as a nervous system, and mechanical joints.

The dummies, built under contract by IIT Research Institute, will be able to simulate from the weakest to the strongest movements,



and their limbs and trunks can be made to grow or shrink to match the stature of most military men who will eventually wear the space suits.

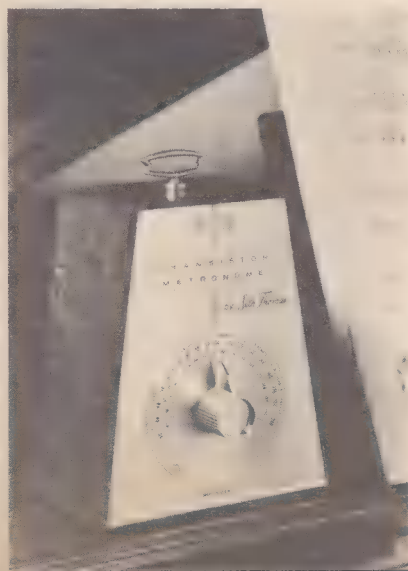
The first job for the dummies will be the evaluation of NASA's existing space suits. They will then aid in designing better ones. The dummies are expected to be of more help than live models because they can provide accurate statistical data on resistance to motion.



### Transistorized metronome

The first transistorized metronome, cordless and requiring no electrical outlet, is being offered by

Transistor metronome, housed in hardwood case of mahogany or walnut, is cordless.



Seth Thomas Division, Thomaston, Conn. The device has an easy-to-set selector knob with adjustable sound selector and precise metro-nomic click.

Available in hardwood cases of mahogany or walnut, the metro-nome has a brushed gold dial for setting the tempo, furniture-protecting felt feet, and a sealed movement to eliminate service problems.

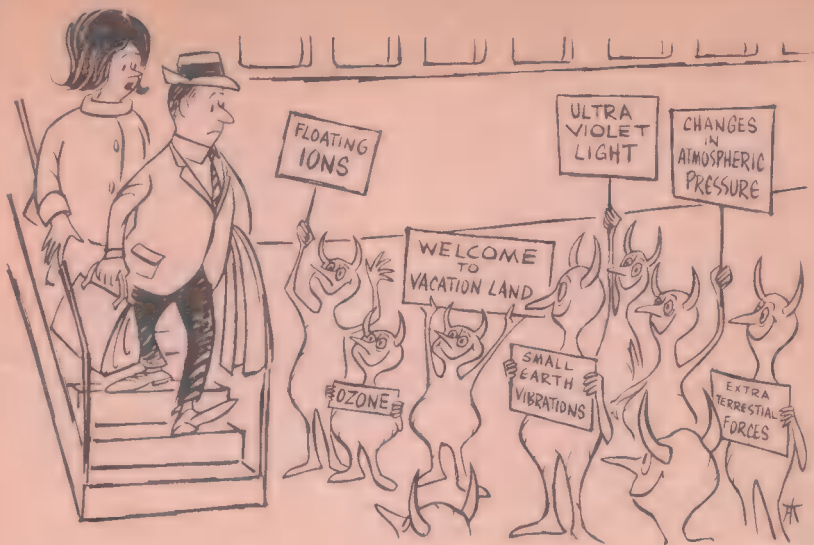
### Cold but clear

A windshield washer anti-freeze has been introduced for easy removal of mud, ice and smears when the temperature goes to zero—and below. The No. "7" Windshield Washer Anti-Freeze is a product of E.I. du Pont de Nemours, Wilmington, Del. It is a blend of chemical ingredients, including methanol, which is said to keep the washer reservoir, hose lines, and jets operating efficiently in temperatures as low as 15° below zero.

The product comes in a one-pint metal can with a cone-shaped top for easy pouring. It is mixed at a ratio of one pint of anti-freeze per two pints of water.

### For nocturnal smokers

For those who like to smoke in the dark but can never find the ash tray, Glo-Lite Products Co., 103 South Western Ave., Los Angeles 4, Calif., offers a luminous ash tray that glows in the dark. Comes in over twenty different sizes and shapes.



While attempting to find the relationship between weather and well-being, scientists have uncovered a world of weather demons which raise a provocative question about

## WINTER HEALTH— SHOULD YOU GO SOUTH?

by Bruce H. Frisch

EVERY winter, thousands of Americans blow their noses goodbye to the snowbound home town and head for the sun. Soon, exulting in untimely spring fever, they seem to shake their colds and bronchial infections. But their physiologies undergo other changes that are not necessarily so benevolent.

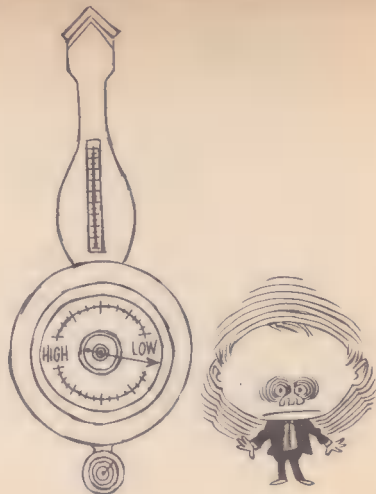
The vacationists arrive confident the sun and climate will cure anything. But after their two weeks in the sun is over, as they step, empty-pocketed, into an icy blast sweeping the home airport, a doubt stirs: "Was the expensive vacation

in the south a health bargain after all?"

A whole science, biometeorology, the study of the effect of environment on life, is devoted to answering such questions. Biometeorology has been out of style in the U. S. but is gaining ground in much of continental Europe. Some of its less inhibited advocates have given it a tinge of quackery that scares away many.

In 1956, the International Society of Biometeorology was formed. The society's secretary-general, C. S. Tromp, who heads the Biometeorol-

One theory held that low pressure increased fluid retention in the tissues, making the brain swell.



ological Research Center in the Netherlands, says, "Unfortunately, many unscientific papers have been published in the past on the subject, both by laymen and scientists, which have done a lot of harm to this new science and undoubtedly hampered its progress during the twentieth century."

Most connections between weather and health are made on purely statistical grounds. Frederick Sargent, professor of physiology at the U. of Illinois, cautioned an international symposium, "For most of the statistical meteorotropisms, there is yet no generally accepted physiological explanation."

The search for such explanations has uncovered a weird world of weather demons. Aside from the obvious effects of weather like frostbite and sunburn, other things we are told to watch are: small earth vibrations called microseisms, floating ions, ozone, ultraviolet light, changes in atmospheric pressure, low frequency electromagnetic waves and mysterious extraterrestrial

forces, perhaps connected to how the earth slices through the galactic field. There are at least a dozen and a half other alleged climatic influences. The scientific evidence for these influences, however, is often pretty sparse.

### The weather and arthritis

Dr. Joseph L. Hollander, Associate Professor of Medicine at the U. of Pennsylvania, has started putting some of these theories to the test. With private and National Institutes of Health funds, he has built a climatic chamber in which he can control temperature, pressure, humidity, number of ions and air circulation. His first group of ten patients were arthritis sufferers known for prophesying the weather. Each spent three to four weeks in the hotel-like chamber while Dr. Hollander altered the environment one factor at a time. Nothing except chilling affected the patients' arthritis. Fast and slow pressure changes, high or low humidity, more

or fewer ions, cool or warm, still or moving air, nothing, did more than affect their general comfort.

Low pressure may increase fluid loss, Hollander concluded. Previously there had been a theory that low pressure increased fluid retention in the tissues, making the brain swell among other things. Coupled with a little statistical evidence, this was used to claim we are more irritable, more incompetent and more criminalistic on low-pressure days.

Acclimatization, in contrast, has been studied fairly thoroughly because of the interest of the armed forces and industry.

Your cold acclimatization is at a peak around February and at a minimum around September. Heat acclimatization follows an approximately reverse cycle, so in January, February and March you are least prepared for hot weather.

When you hit the heat, the hypothalamus, a small portion of the brain behind the eyes and just above the spine, starts sending out signals in an attempt to keep the internal temperature of the body constant. Two and a half million sweat glands moisten your skin. Surface blood vessels open wider to let more heat-carrying blood pass under the cool skin. To fill the expanded vessels, fluids seep from tissues into the blood stream.

While the blood volume quickly increases, the supply of red blood corpuscles takes longer to adjust. For a time, we have "thin blood." The heart works harder to pump more blood. This can cause serious

trouble for weak hearts. During the summer in New York City, the death rate may more than double after a few days of a heat wave. Some doctors advise a little exercise before leaving for the South in winter. It awakens the blood vessels and sweat glands after months of little use.

By the end of a two weeks' vacation, you should have just become acclimatized. You will feel more comfortable. You will sweat less, conserve salt and be able to exercise with a smaller jump in pulse rate.

Returning to the cold is no problem. Your cold acclimatization is still with you. Army tests in a cold chamber at Fort Knox, Ky., indicate that you lose cold acclimatization slowly through a lack of the stimulus of cold, not simply becoming acclimatized to heat. Cold and heat acclimatization are completely separate. It is possible to have both at the same time, and this is what happens when you come home to cold weather.

### Vacation from the cold

But after a long vacation, it is a different story. Several months away from the cold will cause a much greater loss of cold acclimatization. This is especially true if you left for the south early in the winter before becoming thoroughly acclimatized.

In the cold, the surface blood vessels constrict, cutting the flow of blood through the skin as much as 80 percent. The hands are almost



**Don't be surprised if you  
pick up your cold just  
where you left off when  
you return from your  
vacation.**



entirely cut off from the rest of the body. In this way, the outer layers of the body are converted from a radiator into an insulating blanket.

Since your blood volume is high after being in a warm climate, constriction of the blood vessels raises blood pressure. The number of patients admitted to a large Philadelphia hospital with high blood pressure peaked in December and again in the early summer.

If these measures fail to stem the loss of heat, shivering stokes the fires.

Eventually, after acclimatization, a higher metabolism rate makes shivering unnecessary. Blood volume drops, you eat more and don't become so easily chilled.

But don't be surprised if you pick up your cold just where you left off when you return from your vacation. Respiratory diseases are helped, but may not be cured by warm weather. Instead, the viruses and bacteria are likely to lay dormant until you get back to the cold weather they love. Winter is the peak season for respiratory and

heart diseases (even though, in *extreme heat*, the death rate from heart disease rises sharply).

Such statistical correlations comprise the bulk of the evidence that weather affects health.

The one figure that lumps all causes of death is the mortality rate. In a study of several U.S. cities, a Weather Bureau official found that mortality rate is highest in January, lowest in July. Where temperatures drop lowest, mortality rate swings highest. For persons over 65, the swings are most severe. They are less severe but significant for babies under one and for adults between 25 and 64. Between the ages of one and 24, the mortality rate is fairly constant year round.

Diseases can also be correlated with day-to-day weather changes. Since 1958, Budapest, Hungary, has had a daily medical forecast based on correlations with warm and cold fronts, the jet stream, small oscillations in atmospheric pressure and other phenomena.

Some scientists chart the geographical distribution of disease and

check it against climate. Stress diseases in general—ulcers, arteriosclerosis, heart disease—are more prevalent in the North. Some physicians will recommend a particular climate for a particular ill, but even here, there are sharp disagreements. Most doctors refuse to choose one climate as best.

### Prescribing a resort

Recently the Weather Bureau started issuing climatological studies of U.S. resorts. Three are out so far, and about 50 more will follow. They contain long-range averages of such things as temperature spread, rainy and fair weather spells, sunlight and the yearly march of weather. From these studies,

physicians can prescribe for their patients.

Mental ills seem to have seasonal swings of their own. A New York psychiatrist has made plots of his referrals over a 15-year period. The fewest were made in June, July and August, the most in March, April and May.

Wherever you go on a vacation you're likely to get a mental lift. The psychological effect of a vacation is so important that scientists usually can't separate it from the effects of the weather.

If they agree on nothing else, they all say that having fun in a new place far from job worries will do more in the short run to make you feel good than all the galactic fields or ions put together.



### *How to breathe on the moon*

**B**UILDING a plant that can produce oxygen and be sent to the moon by a Saturn rocket—that is the goal of a NASA study program being carried on at the Von Karman Center of Aerojet-General Corp. in Azusa, Calif.

Powered by a nuclear reactor, the plant could be set up and operated either remotely or by astronauts. It would produce 12,000 pounds of oxygen per month from lunar rock, enough to satisfy rocket propellant oxidizer requirements for Apollo flights returning to earth every six months. On a larger scale, the system could also provide oxygen and water for a manned lunar base.

The process of extracting oxygen, according to plan, will be performed in three steps of a continuous cycle. First, a small furnace using methane gas reduces rock to carbon monoxide and hydrogen. The carbon monoxide and hydrogen are pumped to a chemical reactor and converted into methane and water. Electrolysis (chemical decomposition by the action of electricity) reduces the water to hydrogen and oxygen. The oxygen can be stored while the methane and hydrogen are recycled through the system.

Aerojet chemists have already built and operated a chemical reactor for the quantitative conversion of carbon monoxide and hydrogen into methane and water. The construction and operation of a rock reduction furnace will be the next step. The furnace must operate at about 3300° F.

# YOUR SCIENCE ABC's

## Geological eras

### READING THE STORY OF THE EARTH'S PAST

**B**Y TRACING out rock formations and the fossils many contain, geologists and paleontologists have been able to reconstruct a good deal of the earth's past and to obtain clues to evolution and the eras through which the earth has passed.

Astronomers and earth scientists believe that the earth is about  $4\frac{1}{2}$  billion years old. However, no trace of rocks that old has been found on or near the surface of the earth. Perhaps they do not exist; if, as many geologists believe, the earth passed through a molten stage, such rocks would have been melted down.

The oldest rocks geologists have been able to find are about 3 billion years old. Such rocks have been found in Africa and Canada. Their age is estimated from their past radioactivity and is probably correct to within a few hundred thousand years.

The oldest rocks to form massive parts of the earth's crust are probably no more than 2 billion years old. They are called Archaen, and they form deep, solid cores to the continents. They are sometimes exposed at the surface over thousands

of square miles and are generally hard rocks like granite or altered sandstones and slates. They are of immense thickness and contain no fossils. If life existed on the earth when they were formed, it probably took the shape of animalcules or soft-bodied creatures like worms and jelly-fish. It could hardly have included any animals with hard bones or shells, or we should have found signs of them in the rocks.

The oldest rocks containing what may be fossils are a little more than a billion years old. They contain what may be the remains of algae. Some fossils of soft-bodied marine creatures have been found in rocks from Australia, England and Africa that are 700 million years old. But the oldest rocks in which fossils are common are rocks of the Cambrian era, when hard-shelled animals first appeared.

These old rocks are sometimes called Pre-Cambrian, because they came before the Cambrian rocks, which are the first in which undoubted fossils occur. The Cambrian rocks are about 500 million years old, and consist of sandstones, limestones, shales and slates. They include the slabs or "flags" that were once used for paving stones,

and their greatest thickness is about 8 miles, as in British Columbia.

The most common fossils in the Cambrian rocks are trilobites, which were something like large woodlice to look at. Some of them crawled about on the bottom of the sea but others appear to have been swimmers. Trilobites have been extinct for a hundred million years.

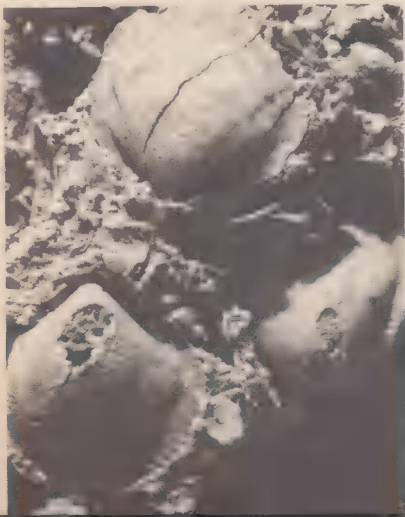
Following the Cambrian rocks come further series of sandstones, limestones, shales and slates. The Ordovician reach 8 miles in thickness in Australia, and the Silurian, 3 miles in Great Britain. All these rocks were formed by about 300 million years ago, and the later ones contain the fossil remains of corals, sea lilies and primitive sea shells as well as trilobites. The Silurian rocks are also noteworthy as containing the earliest remains of land-plants.

Above the Silurian lie the Devonian rocks, rich in corals and

trilobites but containing also the curled shells of ammonites, some large creatures like lobsters and the earliest fishes. A large part of the Devonian rocks in Britain consist of the "Old Red Sandstone," but in Devonshire itself there are enormous masses of limestone made almost entirely of corals. The Devonian rocks reach a thickness of 7 miles, and above them lie 8 miles of the limestones, coal measures and grits of the Carboniferous. These rocks contain fossils of all the old creatures, but there are also the great coal forests, the earliest amphibians and primitive reptiles, and giant dragonflies and other insects.

It should be pointed out that in no single place are all these enormous thicknesses of rocks found together. Most of them were laid down as mud and sand on the bottom of the sea, and while this was going on in some regions there was dry land

Fossils, like the fossilized seashells (below left), are important pieces of historical evidence for geologists. Folded layers of rock, which can be seen clearly in a road cut, (below right), are evidence of earth movements that led to the formation of mountains.





in others. Sometimes the rocks are continuous for a few miles, but then they became dry land while old regions sank beneath the sea to receive the next lot of deposits. The total thicknesses are found by working out the succession of all the depositions and then adding them.

A great deal of the geologist's work consists of working out the movements of the crust of the earth that caused the various change in sea level. Movements of the crust have also brought even the deepest rocks to the surface, where their coverings have been removed by the action of the sea and the weather.

### The first mammals

On top of the Carboniferous rocks comes a thickness of about 7 miles of sandstones and pebble-beds, including the "New Red Sandstone." These formations are known as the Permian and Triassic, and they contain the remains of amphibians and reptiles that lived 190 million years ago. Above them lie the masses of clay and limestone, totalling 4 miles in thickness, of the Jurassic Rocks, full of the fossils of ammonites, shells of all kinds, and some giant reptiles. The first birds and mammals and the first flowering plants also appeared at this time.

On top of the Jurassic rocks comes a great thickness of sandstones, clays and limestones, including the white chalk, their total depth reaching 12 miles in the U.S. These are called the Cretaceous rocks, and they contain abundant fossils of all

kinds of creatures, from microscopic shells and pollen grains to the bones of giant reptiles measuring 100 feet from head to tail. This series of rocks was completed about 100 million years ago, and since then a further thickness of about 12 miles of sands, clays, limestones and pebble beds has been laid down.

This last group is divided into sections according to the proportion of modern animals that are found among their fossils. Immediately above the Cretaceous comes the Eocene, which means "dawn of the recent"; some of the animals that are living today then made their first appearance on the earth. Following this come the Oligocene ("few recent"), Miocene ("less recent"), Pliocene ("more recent"), Pleistocene ("most recent") and Holocene ("wholly recent"). The Holocene rocks include those being formed at the present time.

During the Pleistocene period, which began about a million years ago, the northern hemisphere suffered an Ice Age, during which the ice sheet that covers the region over the North Pole spread until it covered most of Canada and the northern United States, Great Britain as far south as the River Thames, and northern Europe and Asia. Almost all the scenery and mountain landscapes that we now enjoy were carved out for us either by the glaciers of the Ice Age or by rivers of later date. It was during this period, too, that man first began to make tools of stone and wood, and learned how to make fire.

Replacing diseased organs with those taken from live donors or even cadavers, will rank as one of medicine's major life-saving techniques in the future. Here is where we stand on this major medical breakthrough today.

Kidney transplants are now being performed in half a dozen U.S. hospitals. Some have transplanted livers and lungs.

A.M.A. photo



## Medicine's next big

## step — spare parts surgery

by Ralph E. Winter

**S**LOW but steady progress is being made toward a medical objective of the highest importance: successful transplanting of life-sustain-

ing organs from one individual to another.

Transplants were pioneered at Boston's Peter Bent Brigham Hospital in 1951. For many years, however, the only successful transplants involved identical twins,

Reprinted with permission from *The Wall Street Journal* © 1963 by Dow Jones & Co. Inc., 44 Broad St., New York 4, N.Y.

whose body tissues are alike. When surgeons tried to replace diseased organs with healthy ones from unrelated donors, the recipients' bodies invariably rejected the foreign tissues.

"Only five years ago the problem looked almost hopeless," declares Dr. Francis D. Moore, surgeon-in-chief at Peter Bent Brigham. "Now we have an accountant who has been living a year and a half on a kidney taken from a completely unrelated man who had just died. This is a breakthrough that I'm as excited about as putting a satellite into orbit."

Two recent developments heighten the hope that transplants someday may become routine:

Doctors have learned how, through the use of drugs, to control the body's tendency to destroy "foreign tissue," a part of the body's defense against disease.

### Preserved by freezing

Experiments with animals indicate that some parts of the body, such as legs, can be preserved by freezing. Other parts can be kept for six hours or so by cooling them to just above freezing. This may prove to be a modest first step toward eventually solving the problem of obtaining and keeping a supply of spare body parts until needed.

The failure of vital organs of the body ranks as a major cause of death. Some common examples: About 12,000 Americans die each year from chronic nephritis, a kid-

ney disease that has been responsible for most transplants so far. Another 20,000 succumb to cirrhosis of the liver. Cancerous and diseased lungs claim another 45,000. There are 73,000 deaths a year from rheumatic or otherwise degenerated hearts.

Nowhere near all of these victims could be cured by transplants because the ailments often go well beyond a single organ. However, the saving of a significant percentage of patients would involve thousands of lives each year.

This is not to suggest that even this objective is within reach in the near future. Even with kidneys, where the most work has been done, transplant surgery still is highly experimental and not ready for general clinical application. And despite occasional research successes in the preservation of certain parts, there remain to be overcome the enormous problems of obtaining and keeping an adequate supply of spare parts until needed.

Nevertheless, great strides have been made. Only a year or two ago successful transplanting of organs, except between identical twins, seemed a long way off at the least. But now kidney transplants are being performed in a half dozen U.S. hospitals and in France and Great Britain. And doctors are beginning to have frequent successes.

Twenty-six of the last 39 kidney transplants attempted at the University of Colorado Medical Center and Denver Veterans Administration Hospital appear successful, a member of the surgical team reports.

**Five years ago, the problem looked hopeless.  
Now doctors believe that transplants  
will some day become routine.**

Six of the last 11 done at Peter Bent Brigham are doing well. One of the early Brigham patients has had two children since receiving a kidney from her identical twin.

Surgeons are beginning to transplant other organs, too. The Denver doctors have replaced four human livers in recent months. All four patients died, but none from liver failure. One patient lived for 22 days after surgery.

**Survived for a week**

At the University of Mississippi Medical Center in Jackson, surgeons transplanted a lung into a patient whose own lungs were destroyed by cancer and disease. The new lung functioned for 18 days before the patient died, ironically from kidney disease. A lung transplant patient lived a week after surgery at Pittsburgh's Presbyterian-University Hospital.

Doctors contend that even though some patients may die, their survival for a week or so indicates that successful transplants of lungs and livers are not far away. "The fact that the livers functioned for some time after transplant, and in several cases were still functioning well at the time of death, shows that liver transplants are possible," declares

Peter Bent Brigham's Dr. Moore.

Adds a member of the surgical team at Pittsburgh: "You have to remember that these are critically ill patients. Our lung transplant patient was in a coma before we got him to the operating table." Improvement by the patient after the new lung began operating satisfied this surgeon that with small changes in techniques and drug dosages lung transplants soon will succeed.

Heart transplants are probably further off, though some surgeon may well attempt one soon as a final effort to save a dying patient. Dr. Norman E. Shumway, associate professor of surgery at Stanford University School of Medicine, predicts that within five years the heart transplant "will be at the stage where kidney transplants are now."

Already Dr. Shumway and his associates have transplanted hearts from one dog to another and some have lived as long as five weeks. Dr. David A. Blumenstock, director of the surgical research laboratory at Mary Imogene Bassett Hospital, Cooperstown, N.Y., reports that one dog in his experience survived for six weeks after a total heart transplant, and another is living today, four months after transplant of a major heart valve.

At other hospitals, the transplant



**'Use too much drug and the patient doesn't survive.  
If you don't use enough,  
the transplant doesn't survive.'**

of limbs, ovaries, pancreas and other organs are under study. Researchers at Cleveland's Metropolitan General Hospital are even looking into the remote possibility of eventual nerve or brain transplants. Already they have kept monkeys' brains alive for up to 12 hours totally outside the animals' bodies.

### **Built-in defense**

The key to successful transplants is in controlling the body's rejection of foreign tissues. Despite progress in this area, doctors don't completely understand how the rejection mechanism works. They know it is a built-in defense to aid the body in fighting off disease organisms and also in getting rid of mutant cells produced within the body. The process involves production of antibodies by specialized lymphocytes, or white cells, in response to stimulation by complex carbohydrate substances called antigens that are produced by most cells. In the case of disease, the invading organisms produce the antigens and in transplantation they are produced by the cells of the new organ.

"Apparently, each individual has his own set of antigens," says Dr. William Dameshek, professor of medicine at Tufts University School

of Medicine. "The body responds to antigens that it recognizes as 'subversive' by producing antibodies that destroy the cells producing the antigens."

This problem is not present in transplanting an organ from one identical twin to another. Since identical twins are formed from a single fertilized ovum, they are identical in every respect, including antigens. When surgeons attempted to advance to transplants between less closely related or unrelated individuals, however, they found the transplanted tissue was rejected in a matter of days.

Progress began with the discovery by Dr. Dameshek and an associate at Tufts, Dr. Robert Schwartz, that an anti-leukemia drug, 6 mercaptopurine, would retard immunity by halting the growth of certain lymphocytes. They proved that the drug would make animals retain skin grafts at least three or four times longer than usual.

Refinement of this chemotherapy approach has been responsible for most recent advances in transplantation. But even with drugs, controlling rejection is far from simple.

"We are walking on a knife edge in use of immunosuppressive drug therapy," declares Peter Bent Brigham's Dr. Moore. "Use too

much drug and the patient doesn't survive. If you don't use enough, the transplant doesn't survive."

Doctors also are exploring other ways to control rejection. Some surgeons irradiate the transplant area with X-rays, and also use chemotherapy. In another approach, some surgeons remove spleens and thymuses from transplant recipients. Both organs, neither of which is essential for life, have some function in making antibodies, though not all doctors agree that their removal retards rejection.

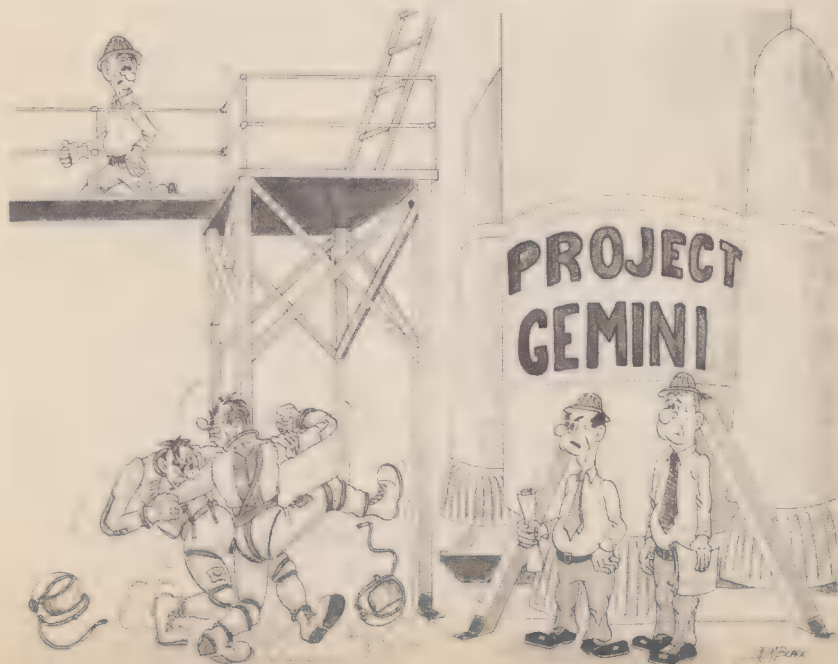
The problem of establishing a supply of organs and other body parts also is formidable. Because an individual can live with only one-fifth of normal kidney capacity, liv-

ing volunteers frequently donate one of their two kidneys for transplantation. But obviously the supply of hearts, livers, lungs and some other organs must come from cadavers.

### Legal problems

At present the use of organs of dead persons is hampered in most states by laws that make it impossible for an individual to legally will his own body to a hospital. Permission to use organs must be obtained from the surviving family after a person's death. Sometimes critical minutes elapse, during which the needed organs may deteriorate.

The problems are great indeed. But the promise is greater.



POEM NO. 027

WHILE LIFE REACHED EVILLY THROUGH EMPTY FACES  
WHILE SPACE FLOWED SLOWLY OVER IDLE BODIES  
AND STARS FLOWED EVILLY UPON VAST WATERS  
NO PASSION SMILED

BY THE RCA 301

POEM NO. 029

WHILE DREAM FLOWED BLINDLY ON BROKEN HOPES  
STILL SPACE DRAINED SICKLY OVER BROKEN LOVES  
YOUR LIGHT DRIVEN SLOWLY FROM FURTIVE MEN  
NO HEAVENS SLEPT

BY THE RCA 301

POEM NO. 078

THOUGH STARS DRAINED SICKLY UPON IDLE HOVELS  
FOR LIFE BLAZED FAST UPON EMPTY FACES  
WHILE BLOOD LOOMED BITTER ON IDLE FIELDS  
NO MARTIAN SMILED

BY THE RCA 301

POEM NO. 105

OUR WATER FLOWED MEANLY AGAINST EMPTY SKIES  
OUR BLOOD DYING EVILLY NEAR EMPTY BODIES  
AND GLOOM FLOWED MEANLY THROUGH GAUNT FACES  
OUR GOD PALLED

BY THE RCA 301

POEM NO. 140

YET LIGHT REACHED BITTER FROM FURTIVE LOVES  
YOUR BLOOD DRIVEN FOULLY BENEATH INHUMAN HOVELS  
FOR STARS DRAINED FREELY AROUND BLACK NEEDS  
THE HEAVENS PALLED

BY THE RCA 301

**T**HERE is apparently no limit to the versatility of electronic computers. They are proving invaluable in helping man get more effective communication systems, improve industrial controls, advance medical research, and further his conquest of space. In addition, computers are now reaching into areas of how men think; how they react to situations; and how they communicate by the thinking process.

An example of the unusual areas in which computers can function was recently demonstrated by Clair

When Phillippy and the computer collaborate, he makes use of an "interrupt" pushbutton on the console to achieve a variety of verse content. As the computer "reads" its programmed vocabulary from tape, Phillippy depresses the "interrupt" button at random and the computer picks a word at that given instant. The same procedure is followed in picking the subsequent nouns, verbs, and so forth. Phillippy has no way of knowing, until he takes a look at the printer output, what the choices were. The three-word

## THE POET IS A COMPUTER

Phillippy, computer specialist. Phillippy worked with an RCA 301—a completely transistorized, general purpose data processing system.

For the experiment, he programmed a basic vocabulary of 100 words which the computer organized and presented on paper as blank verse (left).

To establish a system for the machine, Phillippy selected ten of the 100 words as "starters"—those to be used to begin each line of verse. Other words were segregated depending on whether they were nouns, adjectives, verbs, and adverbs. Phillippy then settled on a format of four-line verses. Each of the first three lines was to contain seven words with the final line held to three.

final line comes from an additional vocabulary of 30 words.

To date, Phillippy and the RCA 301 have produced more than 500 selections of verse. These selections by computer, though electronically composed, are at times reminiscent of Donne, Blake, and such modern poets as Eliot and Cummings. Even the most prolific poets would be hard put to match the computer which has the capability of producing 150 poems a minute (below).







## Hole in the head

IN 1962, a Peruvian brain surgeon, Dr. Francisco Grana, removed a paralyzing blood clot from beneath the skull of one of his patients. In opening the skull, he employed only stone instruments used by ancient Peruvian physicians. His patient survived the operation and recovered.

Thus Dr. Grana proved what many had known but scarcely believed—that physicians of ancient Peru were able to perform trepanation—or operations in which the skull was opened. Hundreds of ancient Peruvian skulls have been discovered with regularly cut holes. More than half of these skulls have shown signs of regrowth, indicating the patient survived the operation.

Jürgen Thorwald tells this story in his excitingly written and beautifully illustrated book *Science and Secrets of Early Medicine*. (Harcourt, Brace & World, New York, 332 pp., \$12). Thorwald discusses medicine in the ancient societies of six countries: Egypt, Babylonia, India, China, Mexico and Peru. Each section opens with a short history of the society.

In our European-centered culture, we like to think that medicine started with the Greeks, and before that all was darkness. Thorwald destroys this notion. The Greeks must have

learned much from earlier societies.

The Egyptians used primitive forms of antibiotics, the Babylonians had operations for cataract of the eyes, the Indians knew of skin transplants and plastic surgery.

Equally fascinating is what modern researchers have discovered about the health of these peoples.

An examination of mummies shows that hardening of the arteries was very common among the upper classes in Ancient Egypt, even among the young.

One of the reasons for this is that despite the idealized slim portraits that have come down to us, many upper-class Egyptians were probably quite fat from overindulgence in the pleasures of the table. Medical researchers have also found physiological evidence to indicate that many of them also suffered from extreme nervous tension. "Intrigues, struggles for power, wars, religious disputes and internal dissension, attempts at poisoning and assassination and their own craving for excitement, must have caused a considerable part of the Egyptian upper class to lead a nerve-wracking life," Thorwald comments.

It's fair to conclude that nothing among our cures, diseases or even our tensions is exclusively a product of modern life.—D.C.

# Is advertising psychology outdated?



**A**DVERTISING men like to think they understand psychology. But according to at least one psychologist, they are way behind the times.

Dr. Milton Rokeach, professor of psychology at Michigan State University, says that most advertising is based on the outmoded theory that man is an irrational creature, who must be appealed to only on an emotional level.

Contemporary psychologists, he says, have rebelled against "the image of irrational man that behaviorism and classical psychoanalysis have helped build." But Madison Avenue, he adds, still clings to its theory of the irrational consumer.



Drawing heavily on behaviorism and psychoanalysis, Dr. Rokeach says advertising men have played heavily on irrational guilt, anxiety, self-doubt and similar "neurotic self-conceptions."

"Advertising has borrowed from psychoanalysis its laws of association and from behaviorism its principles of conditioning; psychoanalysis tells you what to associate with what, and behaviorism tells you how to stamp it in."

Because of this approach, Dr. Rokeach contends, "the advertising industry has come in for a great deal of criticism—to my mind justified—from various sources for a style of advertising that encourages conformity, that is exploitative, debasing, lacking in taste and insulting to the dignity of man."

This style of advertising is not only bad, Dr. Rokeach contends, it is also unnecessary.

"I would say that the major way in which contemporary psychology differs from the psychology of 20 years ago is that man is now seen to be not only a rationalizing creature, but also a rational creature—curious, exploratory and receptive to new ideas."

Advertising could change its psychological approach and successfully appeal to the consumer on a rational basis, Dr. Rokeach concludes.

Another observer, Dr. George

Katona, program director of the Institute for Social Research, Ann Arbor, Mich., warns advertising men that their reliance on "persuasion" rather than "explanation" is stirring widespread consumer resentment.

The housewife, he says, may "act on impulse, but when it matters, she ponders, weighs alternatives and tries to make an intelligent choice."

### Halvah, the talking rat

Ordinarily rats are silent, except when in pain.

But Prof. Stanley Sapon, director of the Department of Linguistics Verbal Behavior Laboratory, University of Rochester, has found a talkative one, and this rat is being used to study the beginnings of human speech.

GURGLE  
GURGLE



While working at the Britannica Center for Studies in Learning in Palo Alto, Calif., Prof. Sapon came upon Halvah, a baby rat being used in an experiment on infant learning. Halvah, unlike other rats, seemed to produce faint gurgling sounds. By giving Halvah a reward of food or water whenever she gurgled, Prof. Sapon developed her special talents to the stage where she indicates hunger and thirst by emitting a sharp gurgling bark.

To determine whether other rats could be trained to vocalize, he then tape-recorded Halvah's noises and played the tapes for two new rats, Demosthenes and Galatea. They, too, proved apt pupils, and now their instructor hopes to teach all three to emit one type of sound when they are thirsty and another sound when hungry.

### Carbon monoxide's other peril

Inhaling low levels of carbon monoxide may impair some mental skills before it produces a physical effect.

That finding of a recent study may have serious implications for astronauts, airplane pilots, train engineers, and many others who must make accurate judgments and have rapid responses while working in an environment where they are exposed to low levels of carbon monoxide.

The study produced "strong indications" that physiologically safe levels of this gas can nevertheless produce impairment of psychological skills which may be a safety hazard, rather than a health hazard.

Dr. John H. Schulte of Washington, D.C., studied the performance of 49 healthy men as they were given relatively simple psychological and physiological tests while exposed to various "safe" levels of the gas. The volunteers were Cincinnati firemen between the ages of 25 and 55.

The volunteers wore special oxygen masks and were not aware of

the presence or degree of the odorless, tasteless gas they were inhaling. The psychological tests included arithmetic, underlining plural nouns, and T crossing.

Dr. Schulte stressed that the degree of psychological change may be "quite profound" before any physical changes could be measured.

Since relatively simple thinking abilities are impaired by low levels of carbon monoxide, he said, "it is highly possible that more complex psychological functions involving judgments, and situational decisions and responses, would be greatly affected," by such low-level exposure.

### People who fear sanity

A small but very noisy group of people in America passionately believe that psychiatrists take their orders from Moscow and that any mental health program is a diabolical plan to control people's minds.

In phone calls, placards, newspaper and radio ads, poison pen letters, and rallies, these enemies of psychiatry shout and whisper their message, reports *Medicine at Work*, a publication of the Pharmaceutical Manufacturers Assn.

Not long ago, Dr. Alfred Auerback of the University of California School of Medicine and Dr. Louis J. Moench of the University of Utah School of Medicine were delivering reports on the anti-mental health movement to a meeting of the American Psychiatric Assn., in St. Louis. As they spoke, a picket

paraded outside with a poster decrying the efforts of psychiatrists to "take over" the minds of their fellow citizens.



Dr. Auerback points out that the anti-mental health movement is merely "an outcropping of the opposition to all scientific progress. There are still pockets of opposition to small pox vaccination and to Salk vaccine. Antagonism to fluoridation of water has mounted in recent years to the point where 14,000 communities are deprived of this caries preventive. For these people, safety lies in what is old and familiar; new habits, new foods, new drugs or new ideas are all viewed with suspicion and apprehension."

Mental health associations across the nation have come under such violent fire, according to reports, that leading citizens have resigned from them as the result of intimidation and the fear of being labeled pro-communist. Several psychiatrists predict that in the years ahead these attacks will increase in proportion to the tensions of domestic politics and international events.

As Dr. Moench points out, the negative forces of fear, hatred and suspicion carry more weight than love, good will and concern for the welfare of others, and he adds:



"Psychiatrists traditionally remain aloof from political strife, but the ivory tower is vulnerable. Each psychiatrist must be aware that his public and private utterances may have widespread and profound effects. His profession does not free him from the responsibility of being a citizen."

### **How to spot a 'pre-delinquent'**

Children in danger of becoming juvenile delinquents can be identified early in life; and by "furnishing skillful and timely therapy and instruction to such children and their parents," it should be possible to save them from a life of crime.

So say Sheldon and Eleanor Glueck, a husband-and-wife research team at Harvard Law School. They have spent over 30 years studying the physical, psychological, and social traits that distinguish delinquents from non-delinquents. From their studies they developed a "Social Prediction Table" which can be used for spotting potential delinquents when they are still young enough to be helped.

The table was constructed from a study of the incidence of 402 traits and factors in a group of 500 delinquent boys and a control group of 500 non-delinquent boys.

A study begun in 1952 by the City Youth Board of New York used 244 boys, between five-and-a-half and six-and-a-half, selected from schools in high-delinquency areas. Their careers were followed to age 17. The results: Of 193

boys identified as having a very low chance of delinquency, 96.4 percent remained non-delinquent; of 27 boys identified as having a high chance of delinquency, 85.1 percent became serious or persistent offenders; of the other 19—which were found to have about a fifty-fifty chance of delinquency—nine became delinquents and 10 remained non-delinquent. Preliminary results of studies made in Washington, D.C., bear out the effectiveness of the identification method.

"The prediction device," the Gluecks warn, "is not some gadget to be applied by anybody untrained in the assessment of parent-child relationships. It is an instrument to be used by those who have had sufficient training in its employment."

"Is it better," they ask, "to let children and parents drift into attitudes and practices that have been shown to produce delinquency; or is it preferable, both for the family and for society, to detect early signs of impending trouble and furnish skillful and timely therapy and instruction to children and parents in situations found to be critical?"

### **Gout: a disease of success**

Gout has long been regarded as a disease of inherited social status. But a study reported in *The Journal of the American Medical Association* finds it to be more identified with business and educational achievements than a heritage of "blue blood."

# Columbus wasn't first

A NORWEGIAN explorer has proved that his ancestors, the Vikings or Norsemen, visited North America some 500 years before Columbus' voyage.

Archaeologists have long thought the sea-roving Vikings visited the North American continent around 1000 A.D. But until now no one has come up with incontrovertible proof—actual Viking ruins or burials.

Veteran Norwegian explorer Dr. Helge Ingstad not only has found ruins; they are perhaps the remains of a settlement founded by the Viking leader, Leif Ericson, himself.

The site is near L'Anse aux Meadows, a small fishing village at the northern tip of the island of Newfoundland. The site closely fits the description of Leif Ericson's settlement in Icelandic sagas.

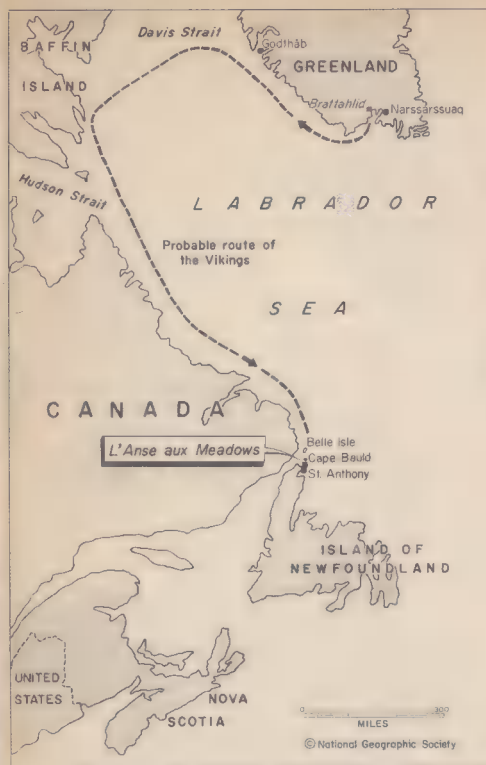
Dr. Junius Bird, Curator of Archaeology of the American Museum of Natural History in New York City, who visited the site, described it this way:

"The evidence of Norse occupation is not visually spectacular. It consists of a number of unpaved floors of houses and other structures and features built upon a sandy beach terrace. The location

photo © 1963, Nat'l Geographic Soc.

Exploratory trenches dug near L'Anse aux Meadows, Newfoundland, have revealed remains of nine structures believed to have been built by the Norse about 1000 A.D.





The Vikings, says Dr. Helge Ingstad, probably went from Greenland to Newfoundland along route indicated by dotted line.

has various drawbacks which combine to make the work of an archaeologist difficult. Highly acid humus or topsoil and the porous subsoil have acted together to destroy the sort of artifacts that have survived at Norse sites in Greenland. With the exception of a few carbonized bone fragments even the bones of the kitchen refuse have leached away and disappeared."

"The virtual absence of artifacts," explains Dr. Henry B. Collins, a Smithsonian Institution anthropologist, "might be explained in several ways. First is the lamen-

table fact that the Norsemen, unlike Eskimos, were such good housekeepers, not inclined to leave broken or lost artifacts in their houses. Secondly, the site in all probability was occupied for only a very short time, probably less than a year. Also, it is worth noting that the near absence of Norse artifacts, disappointing as it is, is not too surprising, especially if the site had been occupied for only a brief period. At many of the Norse ruins in Greenland the yield of artifacts has been exceedingly meagre, in contrast to that from Eskimo sites in the same area."

### When the Vikings sailed

However, radiocarbon dating of charcoal from the ruins indicates that the site was occupied around 1000 A.D., when Leif and other Viking seafarers sailed from Greenland to North America, according to tradition.

Dr. Bird said L'Anse aux Meadows would have been a natural landfill for mariners making the dangerous journey from Greenland without navigating instruments.

The settlement was near distinguishing landmarks, notably a large isle, that cannot be confused with others along the coast. Thus Vikings setting out for Newfoundland could have been given precise instructions. "You can't miss it," Dr. Bird said. Even today pilots of ocean-crossing air transports get their bearing from this island.

Dr. Ingstad, who has been inves-

tigating Arctic regions since 1926, began his intensive search for Norse settlements in 1960. His first three expeditions were supported by Norwegian contributions; one also was assisted by the Arctic Institute of North America.

His work in 1963 was sponsored principally by the National Geographic Society, with Norwegian aid and grants from the Government of Newfoundland.

The four expeditions have excavated traces of nine structures, only a few inches below the sandy surface, and a primitive smithy. One house measured about 60 by 45 feet and had a great hall in the Viking style.

Some of the house sites contained

Dr. Ingstad examines the remains of a fireplace in a settlement that may have been founded by Leif Ericson.

© 1963, Nat'l Geographic Soc.



stone fireplaces and "ember pits"—small square stone holes where coals were kept alive at night. The ember pits are strikingly similar to those found in Norse houses in Greenland.

### Smithy with anvil

The smithy, equipped with a stone anvil, was found in a sandbank close to a river. In the vicinity were several hundred pieces of slag and small bits of iron. Extensive deposits of bog-iron, or iron nodules, lie in marshy areas near the stream. Close by the smithy was a pit with a thick layer of charcoal, evidently a place where charcoal was made to refine the iron.

Dr. Collins said that neither Eskimos nor Indians knew how to extract iron ore from the bog deposits. It is unlikely, he added, that later Europeans would have employed such a primitive technique.

The Vikings, who flourished from the 9th to 11th centuries, were explorers and colonizers as well as sea-roving warriors. The Norwegians pushed westward to Iceland and Greenland, where Eric the Red established the first colony about 987.

It was from the Greenland settlement that his son Leif Ericson, called Leif the Lucky, and others sailed westward to a new landfall, according to the Icelandic sagas. Once dismissed as fanciful, the sagas now are generally accepted as having a factual base.

One saga relates how Leif, in about



1000, discovered a strange new land he called Wineland, or Vinland. Leif's Vinland has been variously located at many different places along the coast from Chesapeake Bay to Hudson Bay. Most scientists have placed it in Cape Cod and Rhode Island, where wild grapes grow.

### Where was Vinland?

But Dr. Ingstad theorized that Vinland was farther north, probably in northern Newfoundland. Aided by an old Icelandic map, he made a systematic examination of the coasts of Rhode Island, Nova Scotia, Quebec, Newfoundland, and Labrador.

Dr. Ingstad's painstaking efforts

were rewarded when he found traces of an old site at L'Anse aux Meadows.

"Theory is nice," Dr. Ingstad reflected, "but a man always needs to have some luck in life. I was lucky."

Although Christopher Columbus, who sailed to the New World in 1492, can no longer be considered the first white man to reach North America, he retains the distinction of being the first whose discovery led to permanent contacts between Europe and America.

Why didn't the Vikings stay? One theory puts the blame on the Skaelings. The Skaelings were probably native Eskimos who at first traded with the Vikings, then attacked and drove them off.



### *Look—no bumper!*

**I**F YOU were cruising along in space in a capsule and suddenly hit a bunch of meteoroids, you would have little to fear from this cosmic collision. Data from Explorer 16 has indicated that most of the meteoroids in space are more like fluffy flakes of dust from decaying comets than dense chunks of metallic rock.

Explorer 16 showed that although 15,000 particles were recorded, only 64 punctured the thin films of metals used in the experiments. Most of the particles were too weak to penetrate a thousandth of an inch of aluminum. On the basis of this data, no meteoroid "bumpers" will be needed on our spacecraft, says Prof. Fred L. Whipple of Harvard University.

For a long time meteoroids were thought to be solid bits of rock and metal in sizes ranging from chunks down to microscopic grains, because of the composition of the fragments that reached earth. Only in recent years have scientists begun to feel that some of the particles had porous structures that broke apart easily.

Most meteoroids seem to be flakes that break away from comets as the sun melts those "dirty ice balls" of space, says Dr. Whipple; the solid meteoroids, however, have the density of iron and probably come from the asteroids. The chances of being hit by one of these, he added, are about comparable to the chance of being hit by lightning here on earth.



# the progress of MEDICINE

by Arthur J. Snider

## What doesn't cause heart attacks

SOME misconceptions about the sort of person who is most likely to get heart attacks have become pretty firmly implanted in the public's mind.

Two Minnesota scientists, Dr. Ancel Keys and Dr. Henry Blackburn, have reviewed hundreds of scientific papers on the factors associated with heart attacks and presented this background evaluation:

**Stress Factor:** The idea that "stress" is important has been so widely accepted, it's astonishing to discover how slender is the scientific basis. The idea that coronary heart disease is an unjust reward of virtue has wide appeal. How much nicer it is for the family to be told that hard work, dedication, and selfless devotion to duty are to blame, Keys says, rather than gluttony and physical indolence.

Some effort has been made to blame stresses of urban congestion, automobile traffic, distractions of telephone, noise, the scramble for position and security. Yet in Japan,

Keys notes, the same stresses are evident but the incidence of coronary heart disease is much less. In rural Finland, where such stresses are conspicuously absent, the incidence is as common as in the United States.

**Personality Factor:** A better case can be made for the theory that personality is a factor. The driving, competitive, restless, impatient individual probably is more prone to heart failure than the placid, easy-going person, not harried by inner drives. But Keys says much more research is needed.



**Familial and genetic factors:** Keys found it difficult to support strongly the widespread conception that one is endowed with arteries

similar to one's forebears. The trick is to separate the extent to which a common environment is responsible from what may be the genetic component.

*Body Type:* There's a long-standing idea that a particular "body" type is dominant among coronary patients. The fat, big-chested, muscular individual (endomorph) is said to be more prone than the slight, lean person (ectomorph). But Keys questions whether this measures a true skeletal type or a nutritional factor.

*Obesity:* Before accepting weight as a major factor in the background of the coronary patient, Keys pauses on the point that a person may be overweight because of his muscle and bone type and still not be obese.

*High Blood Pressure:* A vast amount of literature exists indicating an association between hypertension and coronary heart disease. The risk is more clear cut when high blood pressure is combined with a high cholesterol level.

*Blood cholesterol:* The tendency for coronary patients to have a higher serum cholesterol value is well known. Of more importance is whether a cholesterol elevation promotes the risk of a coronary attack in men with apparent health. In all follow-up studies in the United States, Keys finds the frequency of heart attacks is three times greater for men with high pre-disease cholesterol values than for those with lower values. There is no critical dividing line.

*Blood triglycerides:* Since heart patients tend to have elevation of all serum fats, as well as cholesterol, the question has been asked whether other fat measurements may not be a factor. The greatest interest of late is in the triglycerides. Keys believes the risk of pre-disease triglyceride values is unknown because no follow-up studies on initially healthy persons are available yet.

*Diet:* The link between diet and blood fat levels is well established. The relationship between blood fats—especially cholesterol and coronary heart disease—also is established. But the third leg of the triangle, the direct link between diet and coronary heart disease, is still weak.

*Job and physical activity:* Keys is inclined to subscribe to the general principle that fewer heart attacks may occur among men who habitually exercise outdoors.

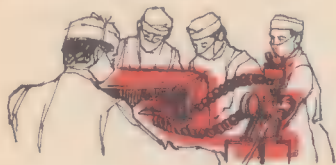
## The man who puts you out

For many patients, the anesthesiologist is the faceless man of medicine. They may never see him and know nothing about what he has contributed to the operation. When a bill arrives from a specialist they never met for a service they never appreciated, they complain.

To improve the "image" of the man behind the mask who makes the operation painless, the American Association of Anesthesiologists is putting \$100,000 into a public relations fund.

"The fact that only 150,000 phy-

sicians were attracted to our specialty in 1962 also is cause for concern," comments Dr. G. E. Kenyon of La Jolla, Cal.



"Is the lack of attraction of anesthesiologists due to the feeling that we are only technicians because some of us act like technicians? Is it because surveys have shown the anesthesiologist has one of the three lowest net incomes among the major specialties?"

The aim, says Dr. Kinyon, is to "impress the patient with the status and importance of the anesthesiologist."

### ***Bursitis—'grin and bear it'***

When Dr. Harrison L. McLaughlin, a New York surgeon, developed a recurrent bout with bursitis, the only therapy he sought for himself was a "high-powered aspirin and a hot water bottle."

There are dozens of treatments for bursitis, the common shoulder pain, but McLaughlin personally favors the "grin and bear it" approach.

Eventually—in a matter of days—nature reduces the inflammation and removes the irritation.

The only alternative is to undergo surgery with its attendant haz-

ards, however minimal, Dr. McLaughlin says. X-radiation and physical therapy are of no proven value. They are often given credit for relief when nature's own curative powers were responsible.

It must be left to the patient himself to decide whether he wants nature or the surgeon to do the job, Dr. McLaughlin says. Only the patient can determine how much discomfort he is having and how much pain he can take. While the patient can be assured the episode is self-limited and thus will end of its own accord, he cannot be told when.

Bursitis is an inflammation of the bursa, a soft-tissue sac that nature puts between bones that glide over one another, as in the shoulder. The purpose is to reduce friction. But occasionally, deposits of calcium form a boil-like pressure on the bursa, causing pain.

Relief comes when the boil builds up with calcium to the point where it "pops" or, in the case of surgery, until it is lanced.



Dr. McLaughlin, professor of surgery at Columbia University College of Physicians and Surgeons, says that bursitis accounts for about two-thirds of all shoulder pains in the general population.



Other major causes are rupture of the tendons, occurring in 20 percent of the population, particularly in the 50 to 70 age group, and frozen shoulder, which is essentially untreatable. For an unaccountable reason, the shoulder becomes increasingly stiff and then, in 18 months or two years later, mysteriously unlimbers again.

### ***In praise of the rocker***

Between operations, Dr. Carl D. Martz, professor of surgery at Indiana University Medical School, lets the ol' rockin' chair get him.

It gently stimulates muscle contraction and thereby improves limb circulation, he says, adding:

"It's extremely rare for a habitual rocker to have swollen feet and legs."



Energy cost is 100 to 150 calories an hour, which is about half that of walking or cycling and less than a third that of horseback riding.

Yet, because of the longer duration, the total muscular effort is greater.

Rocking thus is better tolerated by the aged, the infirm, the convalescent.

"When combined with knitting or friendly conversation, the caloric or

energy expenditure is equal to light housework or light industrial effort," Dr. Martz says, "and with no apparent effort, a healthful exercise program is achieved."

Noteworthy, too, is the tonic effect on the heart and blood vessel system.

Dr. Martz concludes: "A troubled world which clamors for sedation, complains of stiffened joints and sagging muscles, demands pain relief, yearns for physical fitness, and yet needs serenity, and opportunity for contemplation, might well sit and rock awhile."

### **The pre-packaged hospital**

There's no kitchen, no laundry, no bulky sterilizing equipment to be found in the futuristic Atomedic hospital recently dedicated in Montgomery, Ala.

Prepackaged frozen foods (tailored to the diet requirements of each patient) are electronically heated at meal time. All the preparation is done outside the hospital.

The need for a laundry is eliminated by the use of plastic, paper and cotton substitutes for bed linens, cubicle curtains, uniforms, gowns and drapes. In the future, washed instruments will pass under a cobalt-60 bomb, housed in a concrete-lined hole, on a moving band, eliminating the steam bath and sterilizing more efficiently as well as more economically.

Where the average hospital must provide 2.3 to 2.8 persons to care for a single patient, the Atomedic

hospital, with the aid of automation, will require .9 to 1 person for optimum care of one patient.

Of circular construction, the Atomedic hospital provides for a center activity core encircled by 22 wedge-shaped rooms. The windowless rooms are ringed with an exterior corridor through which visitors will pass without hindering the activities of the staff and without contaminating the sterile center area. Personnel will exchange street clothes for sterile garments. The interior wall panel of each room is movable so that surgery and post-operative care will be performed in the central clean area.



In a new technique of operating, the patient will be placed in a plastic tent to insure aseptic conditions. The two operating rooms are portable and set up only as needed, freeing the space for other use. In the tent technique, the surgeon works outside the tent, using plastic gloves built into the plastic unit. Operations may be performed under televised consultation with a distant surgeon.

Automation may also ultimately contribute toward reversing the trend toward specialization in medicine. All information will be instantly available to any specialist in

the nation through computer communication. The patient will thus be left in charge of a general practitioner whom he knows and trusts.

### ***Cancer that cures itself***

The 38-year-old engineer had all the symptoms of an internal cancer. Indeed, at surgery he was found to be in an advanced state. The cancer had spread from its original site to adjacent organs. Further surgery seemed useless and doctors sent him home to die.

Two years later the engineer was back in the same hospital for gall bladder surgery. Doctors were astonished to find on examining the internal organs there was no cancer.

He was one of the rare but fortunate patients whose cancer disappears for no apparent reason.

Dr. Tilden C. Everson and Dr. Warren Cole, surgeons at the University of Illinois medical school, have carefully studied the medical literature and documented 130 cases of spontaneous remission since 1900.

What has happened to cause the body's defenses to mobilize and destroy the malignancy? No one knows, says Dr. Everson. If this could be determined, a new weapon would be available in the cancer war.

"Spontaneous remission supports the concept of biological control of cancer and reinforces the hope that a more satisfactory method of treatment than surgery and radiation may be found in future years," Dr. Everson says.

An aerial photograph of a city, likely Los Angeles, showing a complex multi-level highway interchange with numerous lanes and overpasses. The surrounding urban landscape includes various buildings, parking lots, and smaller roads. The title text is overlaid on the right side of the image.

# THE NEW SCIENCE OF DRIVING

**America's 10,000 miles of freeways  
require motorists to learn a new kind of driving.  
Here are the experts' 12 tips.**

by Andrew Hamilton

**D**RIVING on streets near his home, the 41-year-old Los Angeles man had a heart rate of 79, a breath rate of 15, and a normal galvanic skin response. But as soon as he entered the freeway, his heart pounded up to 111, his breath rate increased to 27 and his GSR peaked sharply. Every time he changed lanes, applied his brakes or approached heavy traffic, the instruments jumped.

This is a picture of what happens when you drive the freeways, Hughes Aircraft Company scientists have discovered. They used Air Force biomeasuring equipment—similar to that which tested John Glenn and the other astronauts when they blasted off into space.

"The average man cruising in 60-mile-an-hour congested traffic," they reported recently, "is likely to be more tense than a highly-skilled astronaut cruising in his space capsule."

Safety experts, traffic police, automobile clubs and insurance companies are in agreement that America's super-highways demand a new kind of driving. Whether called freeways, throughways, parkways, expressways or tollways, these super-

highways are compelling motorists to relearn old driving habits.

Until this new science of driving is mastered, the average motorist, though outwardly calm, will be tighter than a drum inside. And tenseness creates a real danger for himself and other motorists.

I recently discussed this matter with highway and safety officials in California.

"Under the National System of Interstate and Defense Highways

New world of driving starts here. You don't stop before entering, as is normal—but cars on freeway have right of way.



On freeways in Los Angeles, like the Harbor Freeway (left), scientists have found drivers tenser than astronauts.



## Your car may be in good shape, but are you? And do you know the two leading causes of crashes?

now being constructed, it's not just a few states such as California, New York and Illinois that will have super-highways," said Officer Tom Hoyt of the California Highway Patrol. "Almost all states will soon be criss-crossed with high-speed, no-stop arteries. We have about 10,000 miles of freeways now. By 1980 we'll have 41,000 miles."

Freeways, he pointed out, are already our safest mode of surface transportation because they are scientifically engineered. The motorist doesn't have to worry about pedestrians, stop signs, school zones, bicycle riders or narrow streets—only himself and other drivers.

To make them even safer, here are 12 rules suggested by the California Highway Patrol, the Automobile Club of Southern California and the Los Angeles Police Department:

1. *Keep your car in shape*—Freeway driving requires that your car be in tip-top condition at all times—good brakes, turn indicators and lights working, windshield clean, tires capable of fast driving.

Now ask yourself one more question: How's your gas? Running out of gas on the freeway leads to more stalled cars than any other single cause. In Los Angeles County alone last year, some 2,500 cars ran out of gas on the freeways. A good rule

is to keep your tank at least half full at all times.

2. *How about you?*—For most drivers this caution may be unnecessary, but for some it's worth repeating. Don't drive—especially on the freeways—if you're not at your best. Obviously, nobody is at his best after using alcohol, tranquilizers or pep pills, and it's a crime to drive under their influence.

A more innocent-sounding crime, but just as lethal, is to drive when you're angry, worried or overtired. As the highway patrolmen say, "If you need a rest, don't make the freeway your last resting place."

3. *Know where you're going*—It is wise to consult a map before you start out to drive the freeways—even on a short trip—if you're not familiar with the area. It is especially important to know where to get on and where to get off.

There have been instances of people unfamiliar with freeways who have driven 10 to 15 miles out of their way because they didn't know what interchange lane to take or where to exit from a freeway.

4. *Listen to radio reports of traffic conditions*—Most large metropolitan areas provide motorists with up-to-the-minute news bulletins on traffic conditions. In Los Angeles, for example, this service is called

"Sigalert" and information is provided by the Los Angeles Police Department. When freeways are jammed because of an accident, weather conditions or construction, motorists are advised to take alternate routes.

### Avoiding rush hours

It is sometimes well to avoid freeways, even without being instructed, during the 7-9 a.m. rush period in the morning and the 4-6 p.m. rush period at night. Other routes are often faster.

5. *How to get on*—Entering a freeway is different from entering a surface street. In the latter, you come to a dead stop and wait for an opening. But when entering a freeway, you do not stop unless absolutely necessary. Instead, you "merge."

Merging means that you drive up the on-ramp and enter the parallel entrance strip at about the same speed as traffic on the outer lane. Cars in this lane, however, have the right-of-way, and you should merge in smoothly only when there is an opportunity. Once you have entered the freeway, stay in the outer lane until you have adjusted to traffic conditions—then move to the lane that suits you best.

6. *Speed*—Don't drive too fast or too slow on a freeway. These super-highways are faster not because of speed but because traffic flows without stop-and-go. Excessive speed, therefore, is more than dangerous and illegal. It actually causes de-

lays because it disrupts the orderly flow of traffic.

On the other hand, if you are a slowpoke, drive in a slower lane or get off the freeway altogether.

7. *Following*—The greatest single cause of accidents on the freeways is following too closely. Don't be a "tailgater" yourself—and don't let others be one. Watch your rear-view mirror. If another driver is hugging your bumper, slow down, keep to the right, signal him to pass.

The basic rule for keeping distance between cars is this: for every 10 miles per hour of speed, allow a little more than one car length (about 20 feet).

8. *Lane-changing*—Lane-changing is the second most dangerous maneuver in freeway driving. Most cutting in and out is unnecessary. You'll make almost as good time—and be a lot safer—if you pick a lane moving at convenient speed and stay there.

### Checking the blind spot

However, when it is necessary to change lanes, glance in your rear-view mirror, look right and left, and signal well in advance. Lane-changing to the right is particularly critical and the "blind spot" on that side must be carefully checked.

9. *Highway hypnosis*—Long hours of driving at constant speed brings on what scientists call "highway hypnosis." You've probably heard of it—but can you recognize it when it happens to you? You'll be drowsy, glassy-eyed, and in a dangerous

sub-alert state. This means you have lost your ability to judge speed and distance, to recognize danger and to act quickly in an emergency.

What to do to break the spell? Open a window, vary your speed, glance around at the scenery, talk, sing, listen to something lively on the radio. Or, to be really smart, get off the freeway every 100 miles for a short rest or a cup of coffee.

10. *Emergency stops*—Don't stop on a freeway for any reason other than a genuine emergency—such as running out of gas, a flat tire or a mechanical breakdown. If you have to stop, make every sensible effort to move to the outer lane and halt completely off the freeway itself. Most freeways have shoulders or turn-outs for this purpose.

When you're stalled at the side of a freeway, raise the hood of your car, tie a handkerchief to your radio antenna, turn on all lights—anything to signal trouble. By all means stay with your car and don't hitchhike or walk for help. In all probability, a freeway patrol car will pass by within 15-20 minutes and can assist.

11. *Exiting*—Anticipate your exit. Know the names of at least two off-ramps before you reach your exit ramp. Get in the outer lane well in advance and signal at least 100 feet before the turn-off. Slow down to a safe or posted speed. Remember that you've been driving at 60 or 65 miles an hour, and that 35 or 40 can seem like crawling.

Take it easy when exiting and think ahead. Which way will you

turn when you reach the surface street? Watch your speed on surface streets until you have adjusted to the slower traffic.

12. *Bad weather or at night*—There is no magic that will reduce the hazards of freeway driving at night or when conditions are hampered by rain, snow, ice and fog. The basic rule is to slow down.

### Slower at night

Night driving should be about 10 miles an hour slower than day driving, and you should lower your driving lights when cars are approaching in the opposite direction. Bad weather also requires slower driving. On slippery surfaces, make all maneuvers gradually—avoid sudden starts, stops and turns which may result in skidding.

To sum up: Freeway driving requires complete attention to your own driving and to the traffic around you. It demands that you exercise your best judgment at all times, that you think ahead, that you take absolutely no chances.

Several months ago, the Automobile Club of Southern California offered a 2½-hour Freeway Driving Clinic to motorists at no charge. Club officials expected several hundred, but more than 3,000 showed up.

This was an indication that (1) motorists recognize a new science of driving exists, and (2) they are eager to learn more about it. Freeway driving is easier than the stop-and-go battle of the surface streets—and it can be safer.

# Science in the news

Don't look for any change in our national science and space policies under President Johnson. One difference: The new Chief Executive has worked with space administrator James Webb since the Truman Administration. President Kennedy reportedly was cool toward Webb, though eager to push NASA projects.

Johnson has inherited Kennedy's difficulties with the Congress on space and science. The Capitol's drastic cuts of the National Science Foundation's budget are not likely to be revised. Nor are its reductions in the space budget. Two days before Kennedy's assassination, the Senate cut the budget to the \$5.1 billion level to which the House had already pared the space outlay.

Johnson will get on well with scientists in the Government. He supports big research. He has had many sessions with Jerome B. Wiesner, Presidential science adviser. Observers believe he'll also work closely with Donald F. Hornig, chairman of Princeton's chemistry department, who's scheduled to take over from Wiesner this month. Hornig has been getting



## Science in the news

ready for his new job amid growing signs of controversy over the nation's scientific work --where it should be concentrated and how much it costs. Hornig himself agrees it's time to analyze what we're doing and what taxpayers should be expected to support.

At Cape Canaveral, renamed Cape Kennedy, the space effort continues full blast. From there and elsewhere, there will be some 25 shots in '64, including: the huge Saturn rocket; Ranger VI, a moon probe craft; Echo II, a balloon satellite designed to reflect radio signals; OSO, a solar observatory; Gemini, a two-man space ship to prepare astronauts for rendezvous maneuvers, and for the later moon flight, and Mariner C, which will take TV shots of Mars. Toward the end of 1963, we scored a big advance by successfully launching the Centaur rocket. It's the first on record to use liquid hydrogen, a high-energy fuel. That same day, we also put into orbit a new satellite called IMP, which will measure solar radiation up to 122,000 miles away from the earth.

The military also made space news. The Pentagon said a military space laboratory would be launched in 1967 or '68. It also canceled plans for Dyna-Soar, in which a pilot would fly from space back to a landing on earth. The space lab, called Mol, will house two men and be sent into orbit with Gemini. It will be left behind when Gemini returns.

SPACE SHORTS: President Johnson renewed Kennedy's offer to join with Russia in exploration of the moon.....The Soviet Union began a two-month test of spacecraft booster rockets in the Pacific. ...A symposium of astronomers in Dallas discussed observed emanations of X-rays and neutrinos from space, suggesting a new concept of the physical structure of the universe.....MIT and other scientists discovered water in space or, to be precise, the OH radical--an atom of oxygen and one of hydrogen.

Kennedy's assassination became a subject of scientific study. The National Opinion Research Center of Chicago measured public reaction to the killing in a national survey. In Washington, social scientists undertook another study. The results, it was said, will add to the "research on the reactions of normal people under stress."

Congress took an important step in the control of air pollution. It approved a bill authorizing the Secretary of HEW to direct new research and recommend remedial action, including possible Federal suits in cases of interstate air pollution....Also in Washington, President Johnson gave the Enrico Fermi award, the AEC's top honor, to J. Robert Oppenheimer. Once declared a "security risk" (but never disloyal), the man who helped build the A-bomb was congratulated by his critic, Edward Teller.

## Science in the news

The old year ended all dried out. According to the National Geographic Society, drought parched wide areas in 1963, including West Pakistan (where 300,000 people had to abandon their homes), Burma, Malaya, southeast China and Brazil (where the drought hit hardest). In the U.S., drought or near drought prevailed from the Great Plains to New England. Nobody had any explanation.

Look for a boom in the mortarboard market. The National Academy of Sciences predicts that U.S. universities will confer 24,000 Ph.D.'s in 1969--twice as many as in 1962. It adds that the proportion of such degrees in the physical sciences has remained unchanged during the past 40 years. The report refutes arguments that science is displacing the humanities in our universities.

Car been sliding all over the road this winter? Don't despair. The tire industry thinks it finally has an answer to the problems of driving on ice. Several companies have been test-marketing tires in which tungsten carbide studs have been embedded. The studs stick out just enough to grab on ice ( $1/32$  of an inch). Normal, harder surfaces offer no problem. They push the studs back in. ....Another bane of winter, colds, is also the subject of research. The National Institutes of Health have started a Vaccine Development Program. It's a nationwide effort to develop immunity to all respiratory diseases. Schools and drug firms are assisting.

Promised for February: a report on a drug described by one physician as "the most exciting thing I've seen in medicine." It's a chemical compound that has been used in tests over the past few months by Dr. Stanley Jacob of the University of Oregon Medical School and a chemist of the Crown-Zellerbach Corporation. The drug is said to be remarkable for its action against inflammation and pain. Dr. Jacob hopes to provide details when the Society of University Surgeons meets in Los Angeles.

"Heart Disease and Pregnancy." A booklet with that title published by the American Heart Association says that, contrary to a widely-held belief, today most young women with a disease or defect of the heart can safely bear children....The American Cancer Society presented a persuasive new case vs. cigarette smoking. It analyzed the records of 422,094 men from 40 to 79. "Lung cancer death rates were 11 times as high among current cigarette smokers," it reported, "as among men who never smoked regularly."

**QUOTE OF THE MONTH:** "There are too many people behaving like the proverbial ostrich and hoping that science will go away if they bury their heads in the sand, and this in spite of the fact that the last few decades have indicated very strongly that science will not just go away."--DR. ALBERT CREWE, director of Argonne National Laboratory.



GET READY FOR THE SPACE and SCIENCE ERA! SEE SATELLITES, MOON ROCKETS CLOSE-UP

# AMAZING SCIENCE BOYS

for FUN, STUDY or PROFIT

**AUTOMATICALLY SHOWS TIME, TIDES,  
POSITION OF SUN, MOON, STARS**



## NEW SPILHAUS SPACE CLOCK

19 DIFFERENT READINGS  
AT A GLANCE

Stunning scientific achievement, yet completely practical and functional. Designed for the space age by world renowned scientist, Dr. Athelstan Spilhaus, Dean of Technology, University of Minnesota. Handsome conversation piece—constantly up-to-date encyclopedia of the sky. The Spilhaus Space clock has beautiful fruitwood case and 3 sky-blue dials. Blends with decor of any home, office, club room, classroom, museum, display window, hotel, etc. Large dial shows sun position, daily sun rise and set, moon position, moon rise and set, phase of moon, low and high tide time, current stage of tide, day and month of year, current position of stars in sky, time of star rise and star set, relationships of sun, moon and stars, sidereal or star time. Left dial shows local time. Right dial shows world time including major U.S. cities and Universal (Greenwich) time. Operates on house current—requires only one simple setting for any geographic location. Measures 16" high x 11 1/2" wide x 4 1/2" deep. Presentation plaques available. Complete satisfaction guaranteed or money refunded. Stock No. 1201-AD ..... \$150.00 Plus F.E.T.

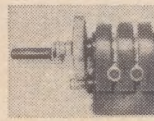
## Bargain! 3" Astronomical Telescope



See the stars, moon, phases of Venus, planets close up! 60 to 180 power—famous Mt. Palomar Reflecting type. Unusual Buy! Equipped with Equatorial mount; finder telescope; hardwood tripod. Included FREE "STAR CHART", 272-page "HANDBOOK OF HEAVENS"; "HOW TO USE YOUR TELESCOPE" book.

Stock No. 85,050-AD ..... \$29.95 pstpd.

## WAR SURPLUS ELECTRIC GENERATOR



Brand-new Signal Corps Generator for endless experiments, electrical users, demonstrations. Generates up to 90 volts by turning crank. Use in high impedance relay, Ring bells. Or charge ground and bring up night crawlers for fishing bait. Has 2 Alnico Magnets. Wt. 2 lbs. Cost to Govt. \$15.00

Stock No. 50,225-AD ..... \$4.95 postpaid

New! 2 in 1 Combination! Pocket-Size  
50 POWER MICROSCOPE  
and 10 POWER TELESCOPE



Useful Telescope and Microscope combined in one amazing, precision instrument. Imported No. 1000 from a fountain pen. Telescope is 10 Power. Microscope magnifies 50 Times. Sharp focus at any range. Handy for sports, looking at small objects, just plain snooping.

Order Stock No. 30,059-AD \$4.50 Ppd.

## SPELLBINDING EXPERIMENTS with SILICON SOLAR CELL and SUN BATTERY!



Experience endless fascination in converting sunlight into electricity to power small motors, amplifiers, etc. Ideal for scientific student projects. Plastic case 1 1/4" x 1 1/4" x 3/16". Produces 3 to .45 volts—10-16 milliamperes. 24-page Handbook gives full data on 12 pat. experiments.

Stock No. 60-216-AD \$2.25 Postpaid Selenium Photocell. Same power, lower price than Silicon Cell.

Stock No. 30,411-AD ..... \$1.50 Postpaid Solar Cell and Photocell Handbook. Fascinating 112-page Handbook on Silicon-Cell and Selenium projects, demonstrations, etc. Explains photovoltaic theory, performance. Gives infrared and ultra-violet applications. Paperbound, 6" x 9". Stock No. 9230-AD ..... \$2.00 Postpaid

HEADQUARTERS FOR "SCIENCE FAIR" PROJECTS



## SCIENCE TREASURE CHESTS

For Boys—Girls—Adults!

Science Treasure Chest — Extra-powerful magnets, polarizing filters, compass, one-way-mirror film, prism, diffraction grating, and lots of other items for hundreds of thrilling experiments, plus a Ten Lens Kit for making telescopes, microscopes, etc. Full Instructions.

Stock No. 70,342-AD ..... \$3.00 Postpaid Deluxe Chest—Everything in Chest above plus exciting additional items for more advanced experiments. Stock No. 70,343-AD ..... \$10.00 Postpaid

## MINIATURE WATER PUMP



Wonderful for experiments, miniature waterfalls, fountains, HO gage railroad backdrops, etc. Tiny (2 5/8" x 1 9/16") electric motor and pump ideal for hobbyists, labs, schools. Pumps continuous flow of water at rate of one pint per minute at a 12" head. With 2 D Batteries in series will pump to 24" high. Runs 48 hrs. on battery. Works in either direction. Self-priming.

Stock No. 50,345-AD ..... \$2.25 Postpaid

## CRYSTAL GROWING KIT



Do a crystallography project illustrated with large beautiful crystals you grow yourself. Kit includes the book "Crystals and Crystal Growing", and generous supply of the chemicals you need to grow large display crystals of potassium aluminum sulfate (clear), potassium chromium sulfate (purple), potassium sodium tartrate (clear), nickel sulfate hexahydrate (blue green), potassium ferri-oxalate (red), and copper acetate (blue green).

Stock No. 70,336-AD ..... \$9.50 Postpaid



MOLECULE KIT — This low-priced kit can be used to make many molecular and crystal models. Consists of 50 sponge-rubber balls, 1 inch in diameter and 50 wooden sticks 6" x 1/8" that can be cut to any desired length. Balls may be painted, after assembly, to standard molecular colors. With this one kit, molecules with up to 50 atoms can be made. Several kits can be used to make up more complex models.

Stock No. 30,413-AD ..... \$2.50 Postpaid

## WOODEN SOLID PUZZLES



12 different puzzles that will stimulate your ability to think and reason. Here is a fascinating assortment of wood puzzles that will provide hours of pleasure. Twelve different puzzles, animals and geometric forms to take apart and reassemble, give a chance for all the family, young or old, to test skill, patience, and, best of all to stimulate ability to think and reason while having lots of fun. Order yours now.

Stock No. 70,205-AD ..... \$3.00 Postpaid

## BUILD A SOLAR ENERGY FURNACE



A fascinating new field. Build your own Solar Furnace for experimentation—many practical uses. Easy! Inexpensive! Use scrapwood! We furnish instructions. This sun powered furnace will generate terrific heat—2000° to 3000°. Fuses enamel to metal. Sets paper aflame in seconds. Use our Fresnel Lens—14" diameter ..... f. 14" Stock No. 70,130-AD, FRESNEL LENS ..... \$6.00 Pstpd. 11" Sq. Fresnel Lens F.L. 19". Slight 2nd. Stock No. 70,533-AD ..... \$6.00 Postpaid.

## MAIL COUPON for FREE CATALOG "AD"

Completely New and Enlarged, 148 Pages - Nearly 4000 Bargains

EDMUND SCIENTIFIC CO.,  
Barrington, N. J.

Please rush Free Glint Catalog-AD

Name .....

Address .....

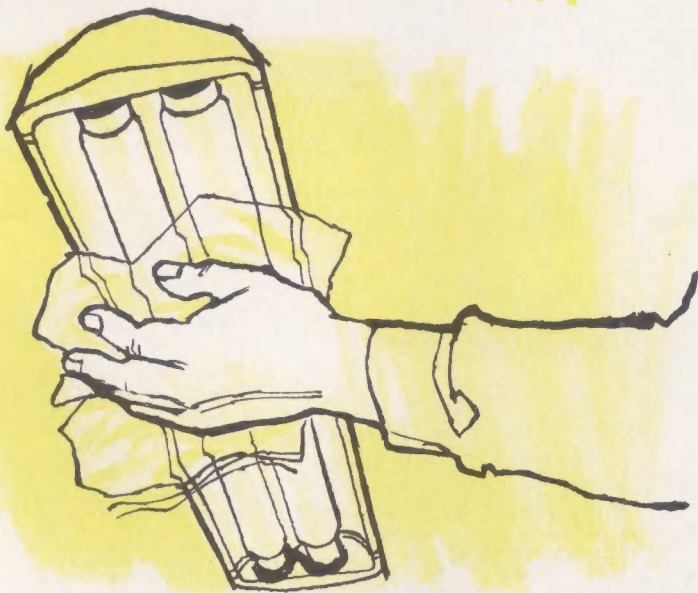
City ..... Zone ..... State .....



ORDER BY STOCK NUMBER . SEND CHECK OR MONEY ORDER . SATISFACTION GUARANTEED!

**EDMUND SCIENTIFIC CO., BARRINGTON, N. J.**

# THE MAGIC LAMP



ACCORDING to the story of "Aladdin and the Wonderful Lamp," a powerful slave would appear by magic whenever the boy rubbed the lamp. You can make magic, too, by rubbing a lamp. You can command the most powerful slave we have—electricity.

In a darkened room, rub the tube of an unlighted fluorescent lamp with a piece of Saran plastic. The tube will glow brightly right under your hand as you rub.

The white coating on the inside of the tube is like the material on the front of a TV tube. Such a coating will glow brightly wherever bits of electric charge, called electrons, hit it. This is what traces the picture on the TV tube.

When you rub the lamp, the charge produced on the outside of the glass attracts other charges on the inside. They strike the coating and make it give off light.

Of course, if the lamp is to shine brightly and steadily, it must get a constant supply of electricity from the wires. In this case, the light is produced in a different way.



## In this issue . . .



These students recently embarked on one of the most unusual and enjoyable educational ventures in history. Their campus is "The University of the Seven Seas," a ship cruising around the world. For the details, see page 40.



What would it be like to be the husband of a Nobel Prize-winning physicist? Dr. Maria Mayer's husband thinks it's just fine. The story of this remarkable woman scientist starts on page 30.



At least three times during its history, the earth was bombarded by large numbers of fragments from the moon. Page 5.



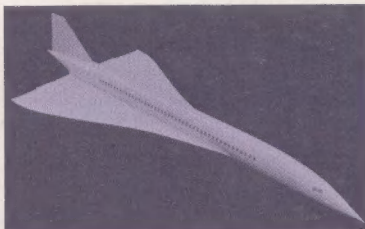
Who says machines have no souls? There is a computer that spends its spare time writing poetry. Although its verse may not be as lyrical as that of the great poets, its production is fabulous. Page 70.



Driving on the new super-highways is tougher on the average driver than orbiting the earth is to an astronaut. For tips on the best way to drive, see page 86.



Among the citizens of newly independent Kenya are members of the El Molo tribe. They exist under conditions so terrible, doctors are surprised they can survive at all. A photo story of the life of this people begins on page 48.



Every major nation in the world is rushing to build a supersonic transport plane. But all they may get is the fastest white elephant in history. Page 23.



Waiting to welcome you back from your winter vacation will be all those cold weather ailments you left behind. And you will wonder if the trip helped your health. Page 57.



Science, particularly Darwin's theory of evolution, and religion have often been considered antagonistic to one another. For a priest's views of evolution, see page 44.